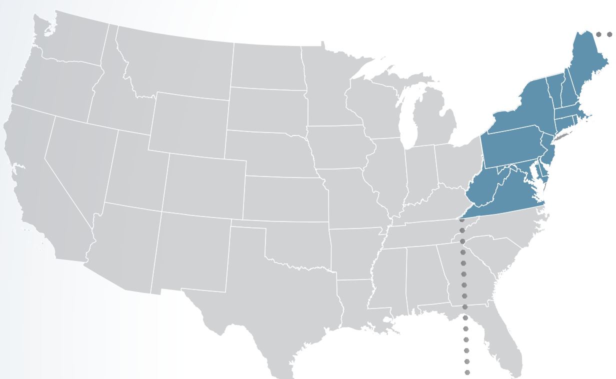
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 11 - CHAPTER 13



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First Responder Network Authority

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Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 11 - CHAPTER 13

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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

April 2016

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13. RHODE ISLAND

The European colonization of Rhode Island was initiated in 1636 by Roger Williams when he was exiled from neighboring Massachusetts due to his political views. Williams encouraged other dissidents to settle the area and successfully petitioned for a Royal Charter to establish Rhode Island as a British colony. Rhode Island was the last of the 13 colonies to become a state by ratifying the U.S. Constitution (State of Rhode Island, 2015a). Located in the northeastern United States, Rhode Island is bordered by Connecticut to the west, Massachusetts to the east and north, and the Atlantic Ocean to the south. This chapter provides details about the existing environment of Rhode Island as it relates to the Proposed Action.

General facts about Rhode Island are provided below:

- State Nickname: The Ocean State
- **Land Area:** 1,034 square miles; **U.S. Rank**: 50 (U.S. Census Bureau, 2010)
- **Capital:** Providence
- **Counties:** 5 (U.S. Census Bureau, 2015a)
- **Estimated Population:** Over 1.05 million people; **U.S. Rank:** 43 (U.S. Census Bureau, 2015b)
- **Most Populated Cites:** Providence, Warwick, Cranston, and Pawtucket (U.S. Census Bureau, 2015c)
- **Main Rivers:** Blackstone River, Pawtuxet River, Wood River, and Pawcatuck River
- **Bordering Waterbodies:** Narragansett Bay, Block Island Sound, Rhode Island Sound, and the Atlantic Ocean
- **Mountain Ranges:** NA
- **Highest Point:** Jerimoth Hill (812 ft) (State of Rhode Island, 2015a)

13.1. AFFECTED ENVIRONMENT

13.1.1. Infrastructure

13.1.1.1. Definition of the Resource

This section provides information on key Rhode Island 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 12.1.1.3 provides an overview of the traffic and transportation infrastructure, including road and rail networks and waterway facilities. Rhode Island's public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in 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 Pennsylvania are presented in more detail in Section 12.1.1.4. Section 12.1.1.5 describes Pennsylvania's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of Pennsylvania utilities, such as power, water, and sewer, is presented in Section 12.1.1.6.

13.1.1.2. Specific Regulatory Considerations

Multiple Rhode Island laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 13.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state's applicable statutes and administrative rules referenced in column one. Appendix C, Federal 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. Code [U.S.C.] § 140126)).

Table 13.1.1-1: Relevant Rhode Island Infrastructure Laws and Regulations

State Laws/Regulations	Regulatory Agency	Applicability
Rhode Island General Laws: Title 39, Public Utilities and Carriers; Title 42, Public Utilities Commission	Rhode Island Renewable Energy Coordinating Board	Evaluates and makes recommendations to optimize energy efficiency and conservation, and energy resource development; monitors and forecasts energy use, prices, and demand and supply; coordinates energy programs for natural gas, electricity, and heating oil to maximize the benefits of conservation and reduce environmental impacts from energy transmission and distribution
Rhode Island General Laws: Title 2, Agriculture and Forestry; Title 20, Fish and Wildlife; Title 23, Health and Safety; Title 46, Board of Certification of Operators of Wastewater Treatment Facilities	Board of Certification of Operators of Wastewater Treatment Facilities	Protects the state's natural resources; preserves swamps, marshes, freshwater wetlands, and coastal land and water; ensures the chemical, physical, and biological integrity of the state's waters; prevents and controls floods; protects groundwater and drinking water supplies; assures land conservation; controls and prevents erosion and the impairment of dams and reservoirs by sediment; oversees conservation districts and renewable natural resources; establishes standards for air and water quality; controls and abates air and water pollution; protects fish, lobsters, shellfish, and wildlife and regulates their taking; establishes and maintains state forests and oversees state parks, hatcheries, and game preserves; maintains waterways; oversees the state's harbors and tidewaters; preserves beach areas; regulates pests, pesticides, waste disposal systems, and underground storage facilities
Rhode Island General Laws: Title 42, Historical Preservation and Heritage Commission	Rhode Island Historical Preservation and Heritage Commission	Protects the state's archaeological resources; evaluates historical, architectural, or cultural sites, buildings, places, landmarks, or areas for inclusion in the state historic register; maintains an inventory and facilitates the preservation of historic landscapes
Rhode Island General Laws: Title 23, Health and Safety; Title 30, Military Affairs and Defense; Title 42, Department of Public Safety	Rhode Island Emergency Management Agency	Ensures disaster preparedness; manages state emergency resources; coordinates disaster prevention, preparedness, response, and recovery; provides emergency management mitigation, preparedness, response, and recovery
Rhode Island General Laws: Title 39, E-911 Uniform Emergency Telephone System Authority	Public Utilities Commission	Regulates heat, light, water, power, sewage, communications, and transportation operators and services; oversees the rates and terms for railroad, gas, electric distribution, water, telephone, telegraph, cable TV, and pipeline public utilities; governs the location of railroad stations; forbears from regulating wireless telecommunications and broadband carriers; maintains regulatory authority over 9-1-1 and local voice service
Rhode Island General Laws: Title 1, Aeronautics; Title 24, Highways; Title 37, Public Property and Works; Title 39, Public Utilities and Carriers; Title 46, Turnpike and Bridge Authority	Public Utilities Commission	Designs, builds, and maintains state roads, bridges, transit, and airport facilities, and ports and waterways; cooperates with cities in the construction of local highways, roads, freeways, and bridges; operates state-owned airports, heliports, and other aviation facilities; regulates the installation, construction, maintenance, relocation, and removal of tracks, pipes, mains, conduits, cables, wires, towers, poles, and other public

State Laws/Regulations	Regulatory Agency	Applicability
		utility equipment; authorizes the use of state highway rights-of-way; plans and operates bus and rail services
Rhode Island General Laws: Title 46, Water Resources Board Corporate	Public Utilities Commission	Coordinates water supply development, conservation, and use for all purposes and functions to minimize waste, protect existing supplies, and manage demand and droughts; formulates long range plans for the development of major water resources and transmission systems; constructs or purchases reservoirs, wells, processing facilities, transmission or distribution systems as necessary

Sources: (State of Rhode Island General Assembly, 2014) (Bureau of National Affairs, 2015)

13.1.1.3. Transportation

This section describes the traffic and transportation infrastructure in Rhode Island, including specific information related to the road networks, airport facilities, rail networks, and ports. The movement of vehicles is commonly referred to as traffic, as well as the circulation along roads. Roadways can range from multilane road networks with asphalt surfaces to unpaved gravel or private roads. The information regarding existing transportation systems in Rhode Island are based on a review of maps, aerial photography, and federal and state data sources.

The RIDOT has jurisdiction over freeways and major roads, railroads, and mass transit in the state; local counties have jurisdiction for local streets and roads. The Rhode Island Department of Transportation (RIDOT) “designs, constructs, and maintains the state's surface transportation system. With a staff of more than 700 transportation professionals, RIDOT serves as the steward of a statewide multimodal transportation network” (RIDOT, 2015a).

Rhode Island has an extensive and complex transportation system across the entire state. The state’s transportation network is comprised of:

- 3,300 miles of roadways and 1,154 bridges (RIDOT, 2015a);
- five rail stations (RIDOT, 2015a);
- 23 aviation facilities that includes both public and private airports (FAA, 2015a); and
- 1 major port.

Road Networks

As identified in Figure 13.1.1-1, the major urban center of the state is Providence (USDOC, 2013a). Rhode Island has one major interstate connecting its major metropolitan area to metropolitan areas in other states. Travel to local towns is conducted mainly via local roads (Rhode Island Department of Administration, Division of Planning, 2015). Table 13.1.1-2 lists the interstates and their start/end points in Rhode Island. 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, 2015).

Table 13.1.1-2: Rhode Island Interstates

Interstate	Southern or western terminus in RI	Northern or eastern terminus in RI
I-95	CT line at Hopkinton	MA line at Pawtucket
I-295	I-95 at Warwick	MA line at Cumberland

In addition to the Interstate System, Rhode Island has State Scenic Byways. State Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities.

Figure 13.1.1-1 illustrates the major transportation networks, including roadways, in Rhode Island. Section 13.1.8, Visual Resources, describes the State Scenic Byways found in Rhode Island from an aesthetic perspective.

State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by RIDOT. Rhode Island has eight State Scenic Byways that crisscross the entire state (RIDOT, 2015b):

- Shannock Road,
- Ministerial Road,
- Veterans Memorial Parkway,
- Paradise Avenue and Associated Roads,
- Great Road/Breakneck Hill Road,
- Route 102,
- Route 114, and
- Route 1.

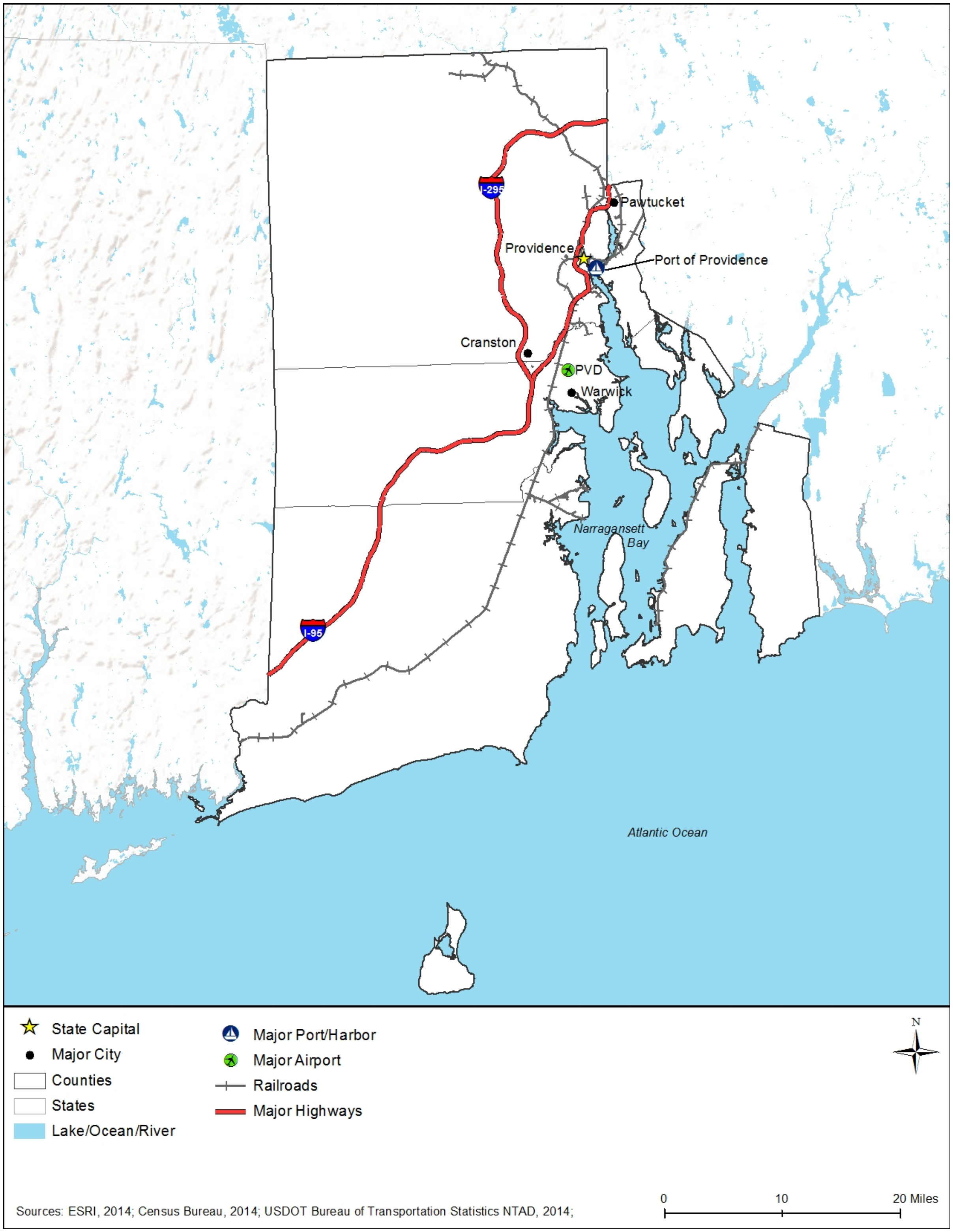


Figure 13.1.1-1: Rhode Island Transportation Networks

Airports

Air service to the state is provided by a number of nearby major international airports, including Logan International Airport in Massachusetts. The largest commercial service airport in Rhode Island is the T.F. Green Airport (PVD), located in Warwick, which is just outside Providence. In 1992, the state created the Rhode Island Airport Corporation "as a semi-autonomous subsidiary of the then Rhode Island Port Authority, now the Rhode Island Economic Development Corporation to operate and maintain the state's airport system… The Rhode Island Airport Corporation is responsible for the design, construction, operation and maintenance of the six state-owned airports; and the supervision of all civil airports, landing areas, navigation facilities, air schools and flying clubs" (Rhode Island Airport Corporation, 2014a).

T.F. Green Airport was originally founded in 1931 as the Hillsgrove State Airport. It was the first state-owned and operated airport in the U.S. (Rhode Island Airport Corporation, 2014b). In 2014, T.F. Green Airport served 3,566,769 passengers and moved 27,334,069 pounds of cargo (Rhode Island Airport Corporation, 2014c).

Figure 13.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 13.1.7, Land Use, Recreation, and Airspace, provides greater detail on airports and airspace in Rhode Island.

Rail Networks

Rhode Island is connected to a rail network of passenger rail (Amtrak), public transportation (commuter rail), and freight rail.

Figure 13.1.1-1 illustrates the major transporation networks, including rail lines, in Rhode Island. Amtrak runs two lines through Rhode Island: the Acela Express and Northeast Regional, which is a popular line, with routes running from Washington, D.C. to Providence, RI in 6 hours 6 minutes and 7 hours 13 minutes, respectively. Additionally, there are Northeast Regional trains from Westerly with a route to Washington, DC in 6 hours and 30 minutes and from Kingston to Washington, DC in 6 hours 51 minutes. In fiscal year 2012, 874,436 passengers boarded or alighted from an Amtrak train in Rhode Island (Rhode Island Department of Administration, Division of Planning, 2014a). Table 13.1.1-3 provides a complete list of Amtrak lines that run through Rhode Island.

Table 13.1.1-3: Amtrak Train Routes Serving Rhode Island

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in Rhode Island
Acela Express	Providence, RI	Washington, DC	6 hours 6 minutes	Providence
Northeast Regional	Providence, RI	Washington, DC	7 hours 13 minutes	Providence
Northeast Regional	Westerly, RI	Washington, DC	6 hours 30 minutes	Westerly
Northeast Regional	Kingston, RI	Washington, DC	6 hours 51 minutes	Kingston

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

Commuter rail service from Rhode Island to Boston is provided by the Massachusetts Bay Transportation Authority under an agreement with the RIDOT (Rhode Island Department of Administration, Division of Planning, 2014a). The Massachusetts Bay Transportation Authority runs one line into Rhode Island: the Providence/Stoughton Line. This commuter train makes three stops in Rhode Island: Providence Station, the Interlink at T.F. Green Airport in Warwick, and Wickford Junction in North Kingstown. The Providence Station facilitated 509,780 passenger boardings on Massachusetts Bay Transportation Authority commuter rail in 2012 (Rhode Island Department of Administration, Division of Planning, 2014a).

Rhode Island does not host any major freight rail lines in the state. The Providence & Worcester (P&W) Railroad, a smaller regional railroad, owns and operates over 29.3 miles in Rhode Island and operates on an additional 8.9 miles of rail line owned by the state of Rhode Island (Rhode Island Department of Administration, Division of Planning, 2014a). The P&W delivers all rail freight shipments to and from the state. In 2011, over 13,000 carloads of freight terminated in Rhode Island; almost 3,000 carloads originated in Rhode Island (Rhode Island Department of Administration, Division of Planning, 2014a).

Ports

Much of Rhode Island is coastal, and a number of ferries run from the mainland and out to smaller islands of the coast. These ferries fall under the jurisdiction of the State of Rhode Island Division of Public Utilities and Carriers and the Public Utilities Commission (RIPUC) (RIPUC, 2014a). Despite its coastal nature, the state only has one major port, the Port of Providence. One of the only two deep-water ports in New England, the Port of Providence is owned and operated by ProvPort, having purchased the port from the city of Providence in 1994 (ProvPort, 2015a). The facility boasts more than 300,000 sq. ft. of warehouse space, as well as onsite rail and 20 acres of open lay down areas (ProvPort, 2015b). As presented in Figure 13.1.1-1, the port can be reached via I-95, which runs along the U.S. east coast. According to U.S. Census Bureau data, the Port of Providence exported over $297 million in goods, weighing 6,834 tons in 2013. That same year, the Port of Providence imported $8.5 billion in goods, weighing 4.52 million tons (U.S. Census Bureau, 2015d).

13.1.1.4. Public Safety Services

Rhode Island public safety services generally consist of public safety infrastructure and first responder personnel throughout the state. The general abundance and distribution of public safety services roughly follow key state demographic indicators. Table 13.1.1-4 presents Rhode Island'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 13.1.9, Socioeconomics.

Table 13.1.1-4: Key Rhode Island Indicators

Rhode Island Indicators	
Estimated Population (2014)	1,055,173
Land Area (square miles) (2010)	1,033.81
Population Density (persons per sq. mile) (2010)	1,018.1
Municipal Governments (2013)	8

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

Table 13.1.1-5 presents Rhode Island's public safety infrastructure, including fire and police stations. Table 13.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 13.1.1-5: Public Safety Infrastructure in Rhode Island by Type

Infrastructure Type	Number
Fire and Rescue Stations	228
Law Enforcement Agencies	39
Fire Departments	156

Source: (National Fire Department Census, 2015)

Table 13.1.1-6: First Responder Personnel in Rhode Island by Type

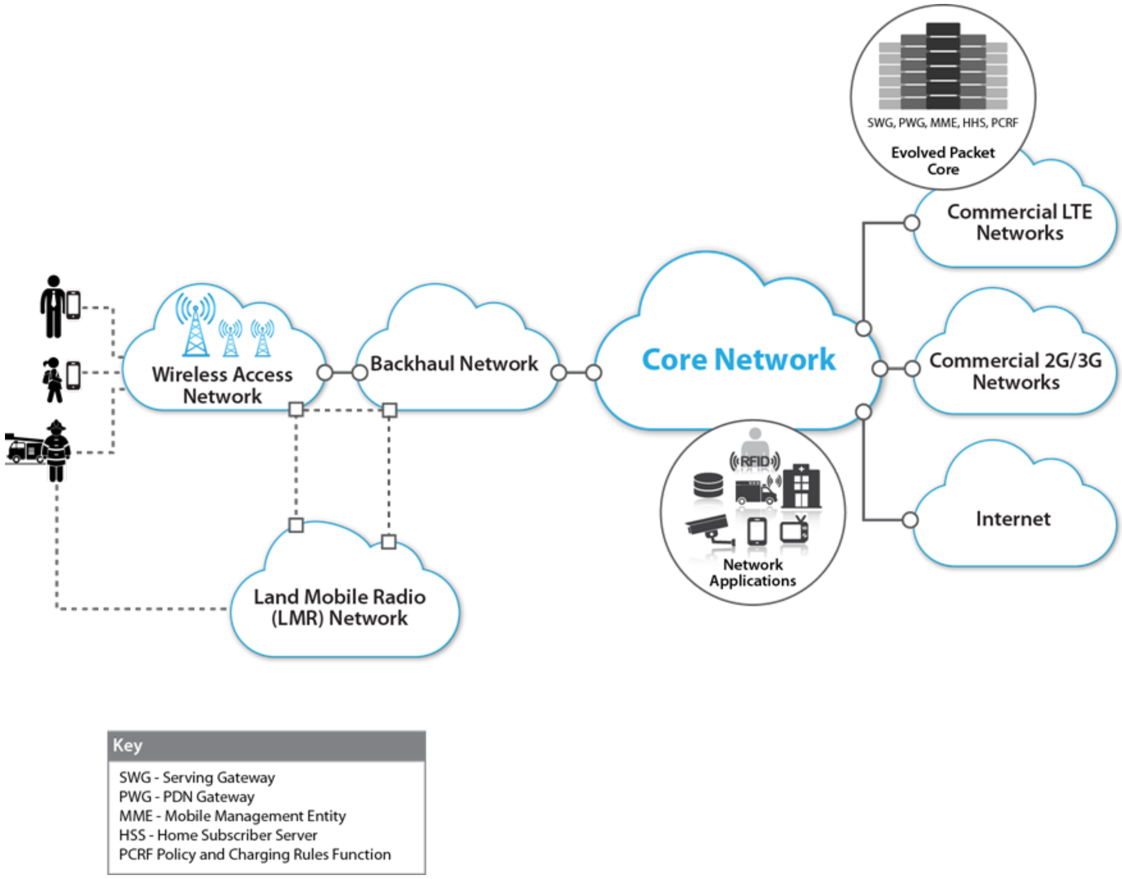
First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers	440
Fire and Rescue Personnel	4,495
Law Enforcement Personnel	7,501
Emergency Medical Technicians and Paramedics	660

Sources: (National Fire Department Census, 2015) (BLS, 2015a)

13.1.1.5. Telecommunications Resources

Telecommunication resources in Rhode Island can be divided into two primary categories: specific public safety communications infrastructure and commercial telecommunications infrastructure (FCC, 2015a) (BLS, 2016). There is no central repository of information for either category; therefore, the following information and data are combined from a variety of sources, as referenced.

In general, the deployment of telecommunications resources in Rhode Island is widespread and similar to other states in the U.S. 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 13.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including an LTE evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).



Prepared by: Booz Allen Hamilton

Figure 13.1.1-2: Wireless Network Configuration

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 long term evolution (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 U.S. and at the state level, including in Rhode Island.

There are five key reasons why public safety agencies often cannot connect through existing communications (NTFI, 2005):

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

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

Public safety communications in Rhode Island are similar to those in other states and consist of a mix of older analog networks across Very High Frequency (VHF)[2], Ultra High Frequency (UHF)[3], and digital narrowband Project 25 (P-25)[4] upgraded wireless infrastructure systems (RISCIP, 2007).

Rhode Island's public safety and emergency communications networks operate across a diverse set of channels and licensed wireless frequencies including VHF, UHF, and 800 Megahertz (MHz) to serve multiple public safety users and agencies. In 2003, Rhode Island engaged RCC Consultants, Inc. to conduct an assessment of the current state of its wireless communications networks and review requirements and options to support the development of an integrated statewide network[5] that would meet both public safety and broader state agency communications needs. At that time, there were four separate Rhode Island networks operating in the state: (1) RIDOT, (2) Rhode Island Transit, (3) Rhode Island State Police, and (4) Department of Environmental Management. In addition to noting the highly diverse radio systems in use in the state including digital, analog, conventional, and trunked systems, Rhode Island radio technical planners cited three main problems that a statewide radio communications network would need to address: (1) lack of functional interoperability, (2) insufficient number of operating channels, and (3) the need for improved coverage (RCC Consultants, 2003). The same RCC study noted that there was a duplication of 800 MHz technology-based radio networks in the state due to multiple networks across the Rhode Island Public Transit Authority (RIPTA), RIDOT, and Rhode Island Department of Corrections (RIDOC) leading to operational and spectral inefficiencies (RCC Consultants, 2003).

As a result of the 2003 study and follow on analysis, Rhode Island created the Rhode Island Statewide Communications Network (RISCON) to address incompatibility of the older radio

[2] VHF band covers frequencies ranging from 30 MHz to 300 MHz. (NTIA, 2005)
[3] UHF band covers frequencies ranging from 300 MHz to 3000 MHz. (NTIA, 2005)
[4] P-25 defines standards for "interoperable, digital two-way wireless communications products" (Project 25 Technology Interest Group, 2015)
[5] Referred to in 2003 as a Statewide Radio Communications Network (SRCN)

networks in the state and position the state for future LMR enhancements. RISCON is a digital P-25 800 MHz system that was developed by linking three existing 800 MHz projects: the Washington County Interoperable Communications Project, the Town of Providence/Providence County/Northern Rhode Island trunked radio network, and the City of Providence network (Rhode Island Emergency Management Agency, 2014). In addition to the RISCON 800 MHz network, there are a number of other 800 MHz networks in the state including the RIDOT, RIPTA, the Rhode Island Department of Corrections, and Rhode Island Department of Health/Hospitals. Currently it is estimated that 75 percent of Rhode Island's first responders use RISCON (Rhode Island Emergency Management Agency, 2014). Figure 13.1.1-3 depicts the deployment of RISCON.

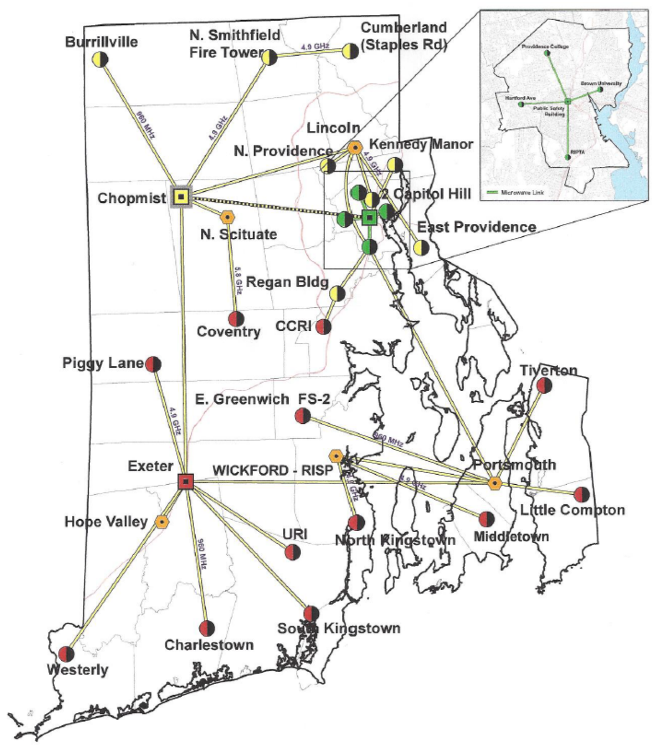


Figure 13.1.1-3: RISCON Network Deployment Map

Source: (Rhode Island Emergency Management Agency, 2014)

Responsibility for RISCON resides with the Rhode Island Emergency Management Agency per Rhode Island Law which states: "The Rhode Island emergency management agency is hereby authorized and empowered to provide for the installation, operation, and maintenance of a statewide interoperable communications system for the purpose of promptly collecting, exchanging, disseminating, and distributing information relating to police, fire, first responder, and first receiving health care facilities of the state. The system is to be installed, operated, and maintained in such cities and towns and entities as have organized systems, and may connect directly or indirectly with similar systems in other states in accordance with rules and regulations as promulgated by the Rhode Island emergency management agency" (Justia.com, 2015).

Operational ownership and technology management of other agency and mission-specific networks such as the RIDOT; legacy county/local police, fire, and Emergency Medical Services (EMS) networks; and State Police VHF networks are handled by the respective agencies or jurisdictions.

Statewide Networks

There are three state-wide Public Safety/Defense wireless networks operating in the state of Rhode Island currently: (1) the RISCON, (2) the RIDOT, and (3) the U.S. Department of Defense (DoD) networks (operating in the 800 MHz band) (RadioReference.com, 2015a). The RISCON network is an upgraded digital P-25 network while the DoD (BEE00-14C) network covers the state and operates nationwide. Both the RISCON and DoD networks are digital P-25 networks while the RIDOT network is an analog Motorola Type II Smartnet network (RadioReference.com, 2015b). In addition to the 800 MHZ networks providing statewide coverage, VHF statewide emergency calling is provided over the Rhode Island State Police Emergency Radio Network (RISPERN) network for law enforcement users and Search and Rescue (SAR) statewide communications.

The Department of Corrections and the RIDOT, although offering multi-county coverage, do not fully provide statewide coverage as currently deployed (RadioReference.com, 2015a).

Regional Networks

In addition to the capability of the 800 MHz statewide network, RISCON, to support geographically segmented simulcast calling, VHF frequencies service a large number of regional and local public safety user groups in Rhode Island. Within the RISCON network using the 800 MHz band there are multiple, specific regional talk groups that benefit from statewide coverage including Rhode Island State Police, EMS talk groups including hospitals and LIFESPAN[6], statewide fire talk groups, and statewide fire and police mutual aid/intersystem talk groups. VHF public safety networks operating in the VHF frequency band include: county emergency communications/mutual aid use, fire and police dispatch, police car-to-car communications, and law encrypted frequencies.

Rhode Island is also leveraging the UHF frequency for multiple uses in public safety including county emergency communications and agency-specific applications, such as police and fire dispatch, EMS, and SAR.

Public Safety Answering Points (PSAP)

According to the Federal Communications Commission (FCC)'s Master PSAP registry, there are 72 Primary PSAPs in the State of Rhode Island (FCC, 2015b). These centers are operated by a combination of State Police, local police, county emergency services, and military emergency communications dispatch facilities throughout the state.

[6] LIFESPAN is a consortium of five partner hospitals in Rhode Island

Commercial Telecommunications Infrastructure

Rhode Island'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 sub-sections present information on Rhode Island'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

Rhode Island'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 13.1.1-7 presents the number of providers of switched access[7] lines, Internet access[8], and mobile wireless services including coverage.

Table 13.1.1-7: Telecommunications Access Providers and Coverage in Rhode Island, as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage
Switched access lines	89	98% of households
Internet access	22	74% of households
Mobile Wireless	4	93% of population

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

[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

Table 13.1.1-8 shows the wireless providers in Rhode Island along with their geographic coverage. The following three maps, Figure 13.1.1-4, Figure 13.1.1-5, and Figure 13.1.1-6, show: 1) the combined coverage for the top two providers, AT&T and Verizon Wireless (each of which covers the entire state); 2) Sprint's coverage; and 3) T-Mobile's coverage, respectively.

Table 13.1.1-8: Wireless Telecommunications Coverage by Providers

Wireless Telecommunications Providers	Coverage
AT&T Mobility LLC	100%
Verizon Wireless	100%
Sprint	81%
T-Mobile	77%

Source: (NTIA, 2014)

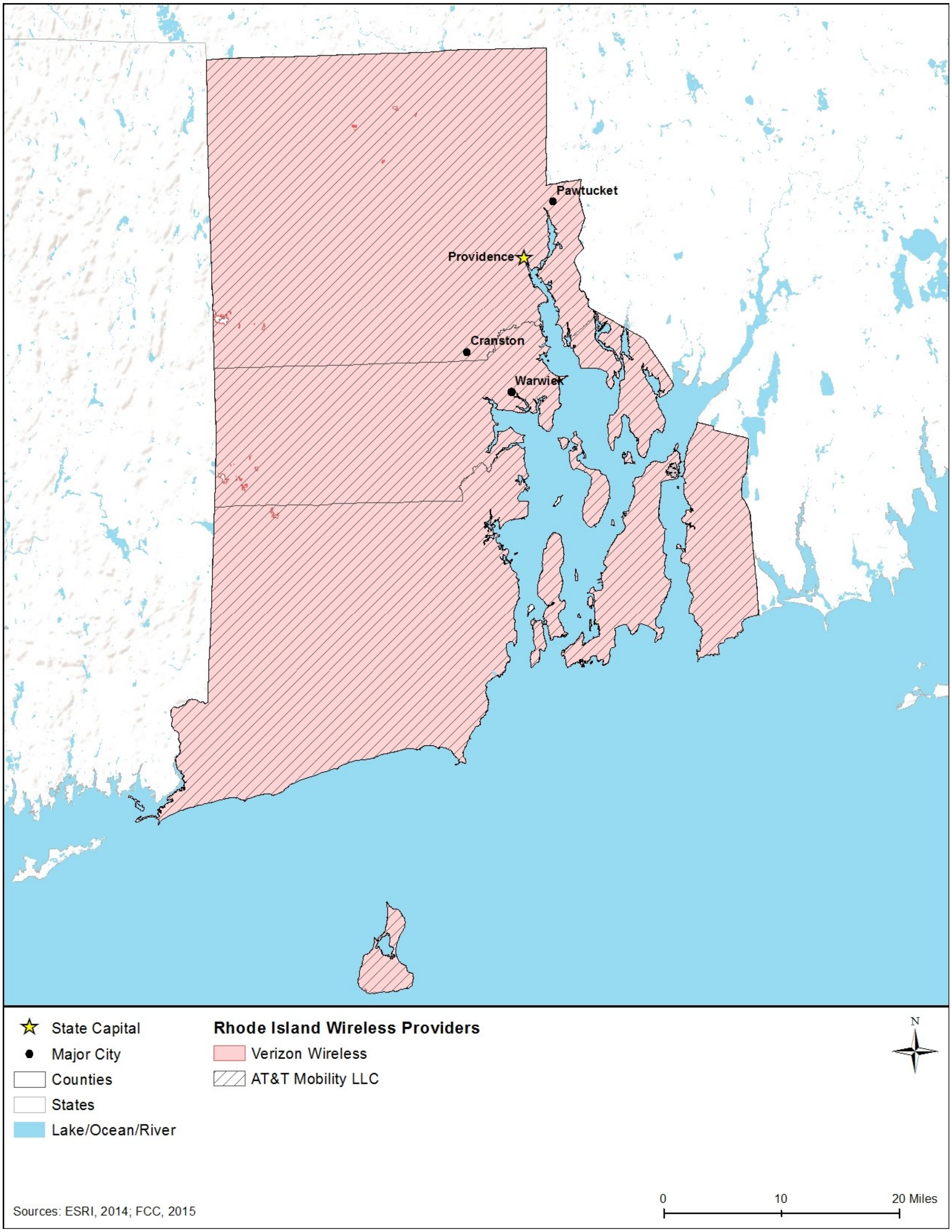


Figure 13.1.1-4: AT&T and Verizon Wireless Availability in Rhode Island

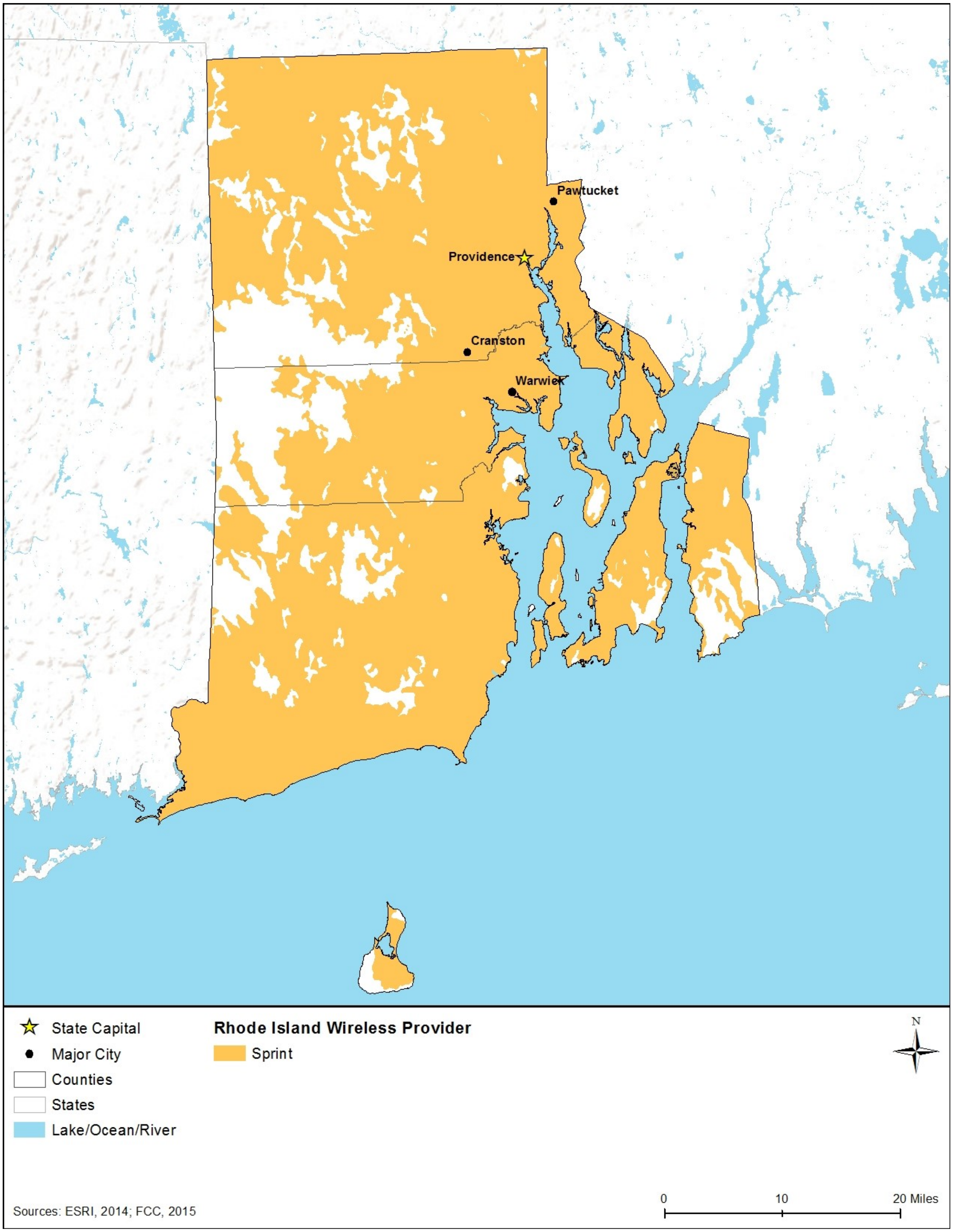


Figure 13.1.1-5: Sprint Wireless Availability in Rhode Island

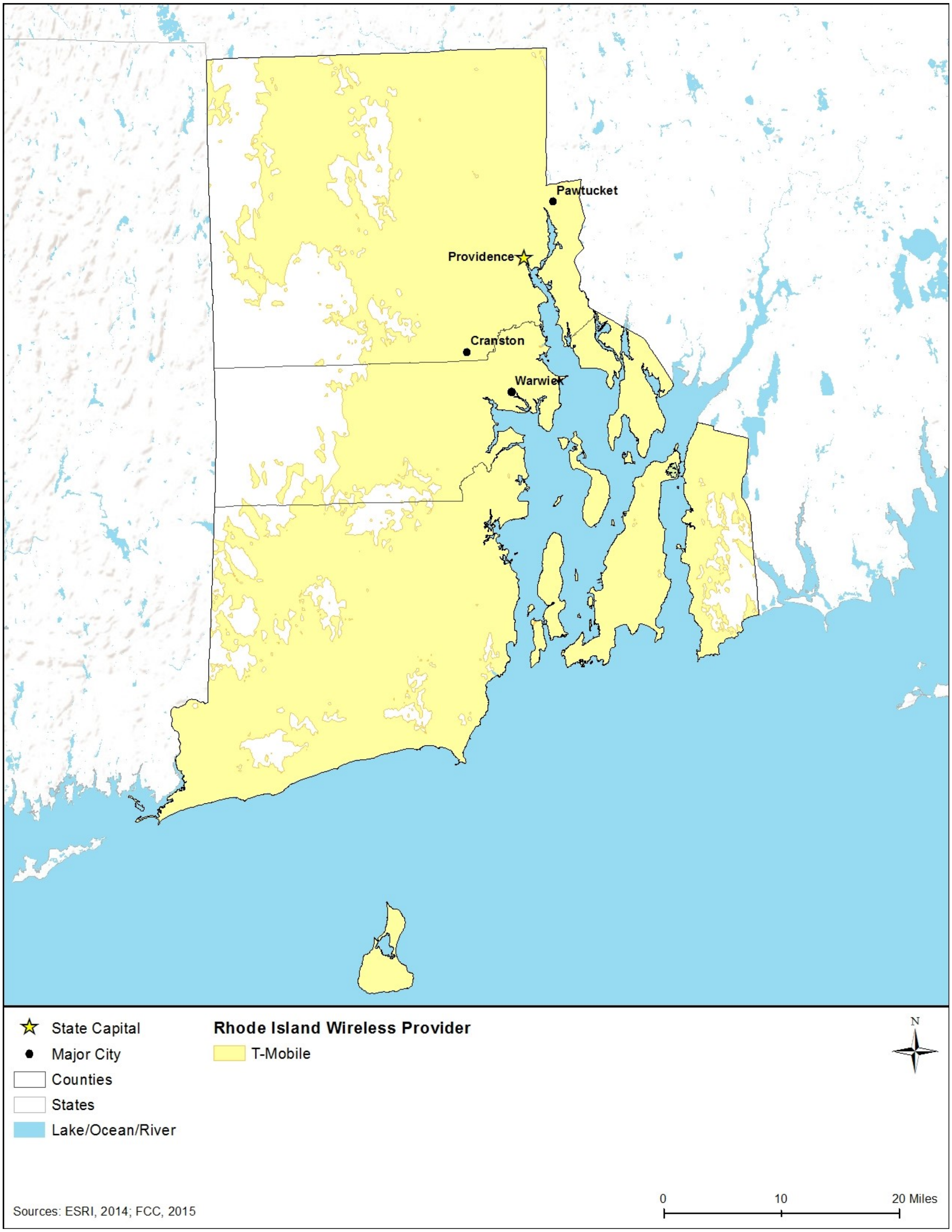


Figure 13.1.1-6: T-Mobile Wireless Availability in Rhode Island

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 13.1.1-7 presents representative examples of each of these categories or types of towers.

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

Lattice
200 – 400 feet
Source: Personal Picture

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

Figure 13.1.1-7: Types of Towers

Telecommunications tower infrastructure can be found throughout Rhode Island, in a fairly scattered pattern. Owners of towers and some types of antennas are required to register those infrastructure assets with the Federal Communications Commission (FCC) (FCC, 2016b).[9] Table 13.1.1-9 shows the number of towers (including broadcast towers) registered with the FCC in the state of Rhode Island. Figure 13.1.1-8 shows the location of those 149 structures, as of June 2015.

[9] 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.

Table 13.1.1-9: Number of Commercial Towers in Rhode Island by Type

Constructed[a] Towers[b]		**Constructed Monopole Towers**	
100ft and over	9	100ft and over	0
75ft – 100ft	16	75ft – 100ft	0
50ft – 75ft	52	50ft – 75ft	2
25ft – 50ft	53	25ft – 50ft	4
25ft and below	3	25ft and below	0
Subtotal	**133**	**Subtotal**	**6**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	0	100ft and over	0
75ft – 100ft	0	75ft – 100ft	0
50ft – 75ft	0	50ft – 75ft	1
25ft – 50ft	0	25ft – 50ft	1
25ft and below	0	25ft and below	0
Subtotal	**0**	**Subtotal**	**2**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	0	100ft and over	0
75ft – 100ft	0	75ft – 100ft	0
50ft – 75ft	2	50ft – 75ft	0
25ft – 50ft	2	25ft – 50ft	0
25ft and below	1	25ft and below	0
Subtotal	**5**	**Subtotal**	**0**
Constructed Tanks[d]			
Tanks	3		
Subtotal	**3**		
Total All Tower Structures		**149**	

Source: (FCC, 2015c)

[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, 2013)
[b] Free standing or guyed structure used for communication purposes. (FCC, 2013)
[c] Multiple constructed structures per antenna registration. (FCC, 2013)
[d] Any type of tank – water, gas, etc. with a constructed antenna. (FCC, 2013)

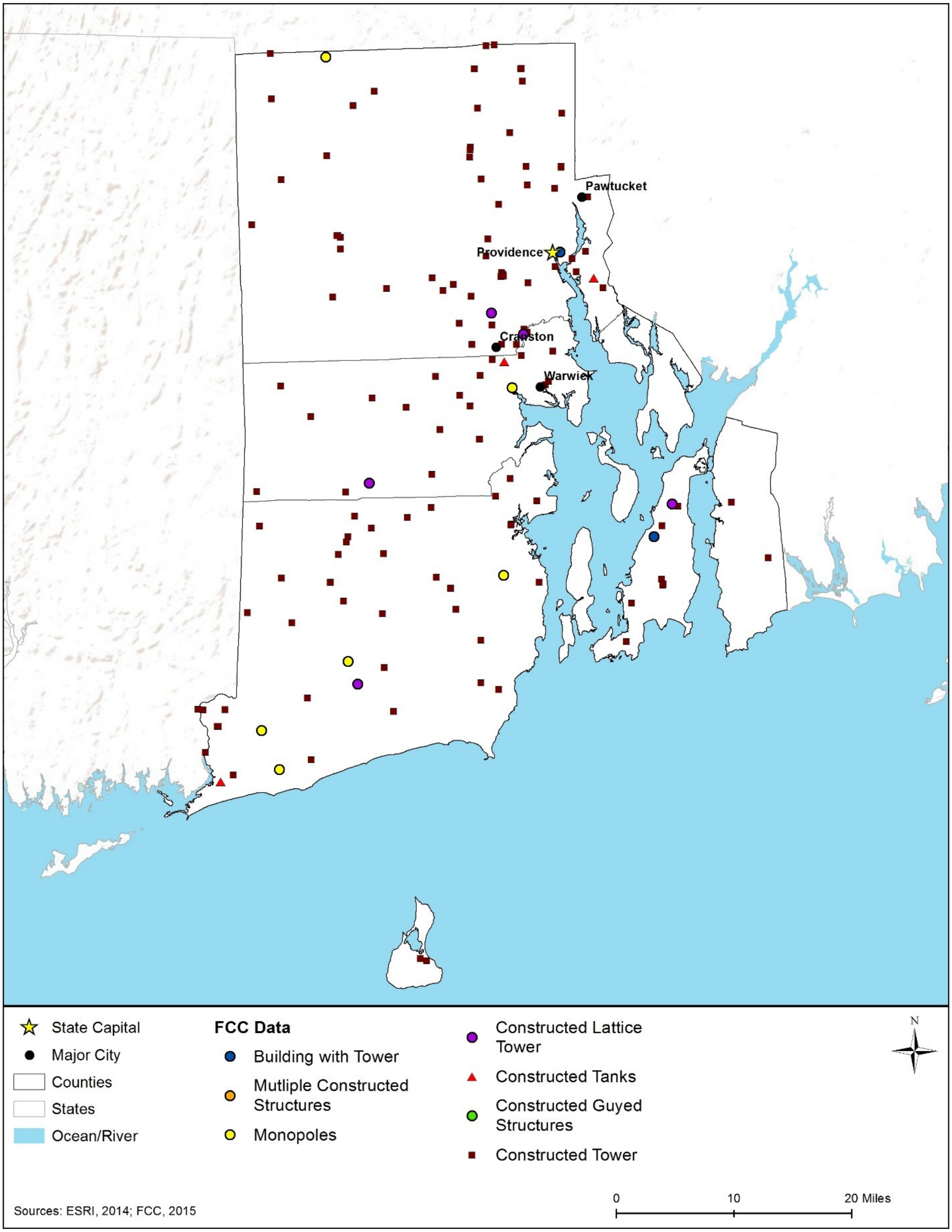


Figure 13.1.1-8: FCC Tower Structure Locations in Rhode Island

Fiber Optic Plant (Cables)

Fiber optic plant, or cables, can be buried directly in the ground; pulled, blown, or floated into ducts, conduits, or innerduct (flexible plastic protective sleeves or tubes); placed under water; or installed aerially between poles, typically on utility rights-of-way. A fiber optic network includes an access network consisting of a central office, distribution and feeder plant (cables of various sizes directly leaving a central office and splitting to connect users to the network), and a user location, as shown in Figure 13.1.1-9. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).

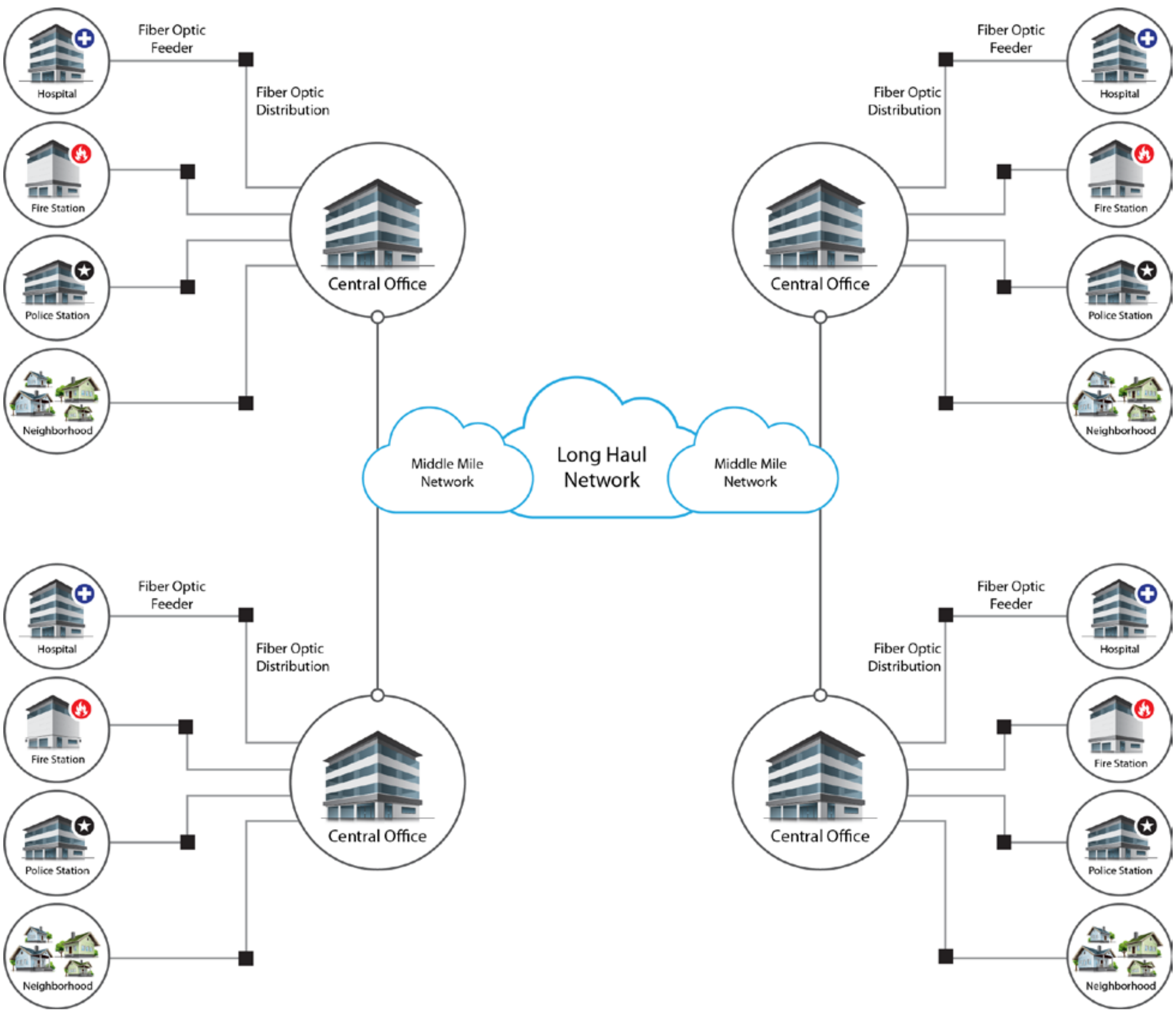


Figure 13.1.1-9: Typical Fiber Optic Network in Rhode Island

Prepared by: Booz Allen Hamilton

Last Mile Fiber Assets

In Rhode Island, fiber access networks are concentrated in the highest population centers as shown in the figures below. There are 13 fiber providers that offer service in the state, as listed in Table 13.1.1-10. Figure 13.1.1-10, Figure 13.1.1-11, Figure 13.1.1-12, Figure 13.1.1-13, and Figure 13.1.1-14, show coverage for Cox Communications, Earthlink and Megapath, Verizon, OSHEAN and Lightower Fiber Networks, and other providers, respectively.

Table 13.1.1-10: Fiber Provider Coverage

Fiber Provider	Coverage
Cox Communications	96.25%
Earthlink	96.11%
Verizon	82.59%
OSHEAN	74.96%
Lightower Fiber Networks	17.85%
Megapath	17.67%
Other[a]	.11%

Source*:* (NTIA, 2014)

[a]Other: Provider with less than 5% coverage area. Providers include: Broadview, Full Channel, Verizon New England, Inc., Level3, Fibertech, Cogent Communication, Zayo.

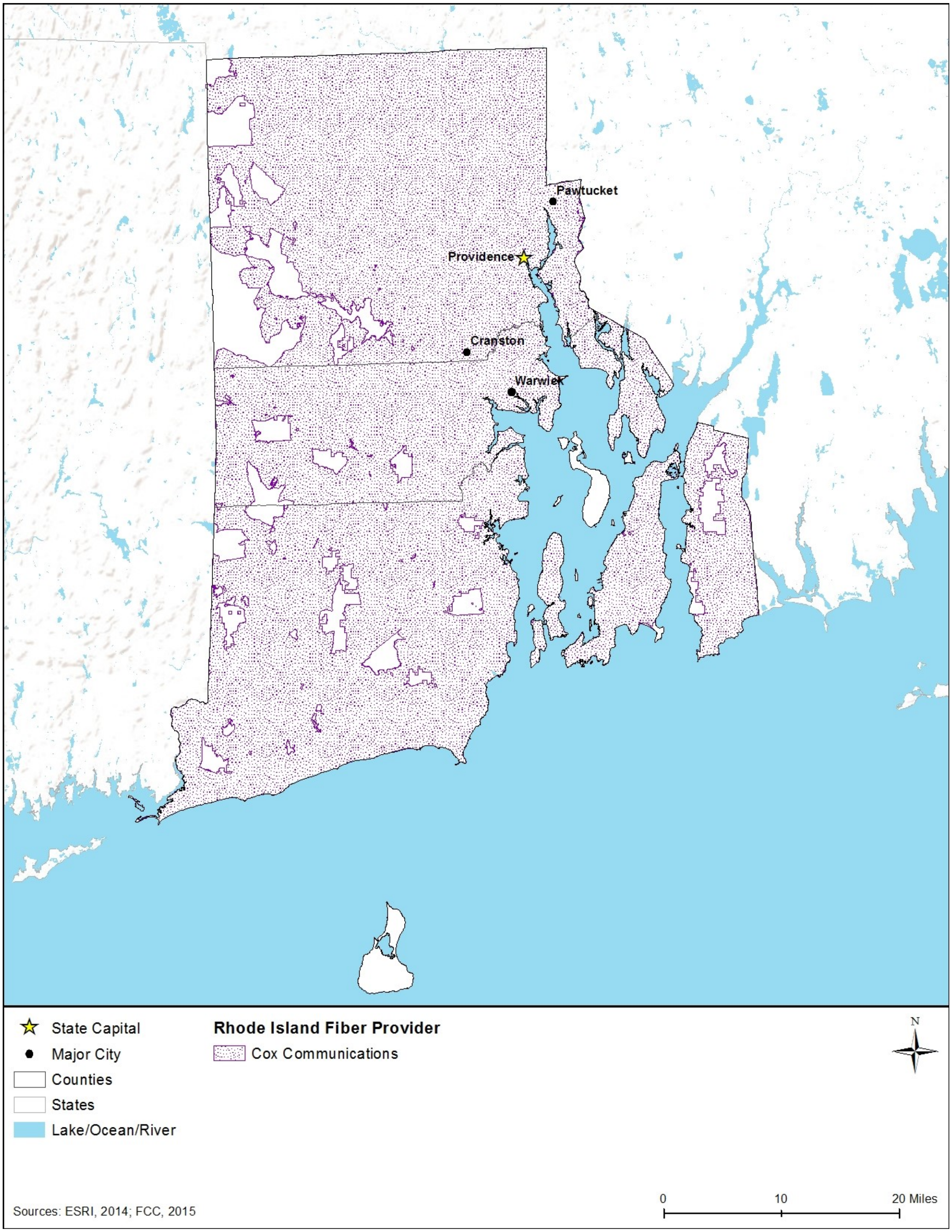


Figure 13.1.1-10: Cox Communications Fiber Availability in Rhode Island

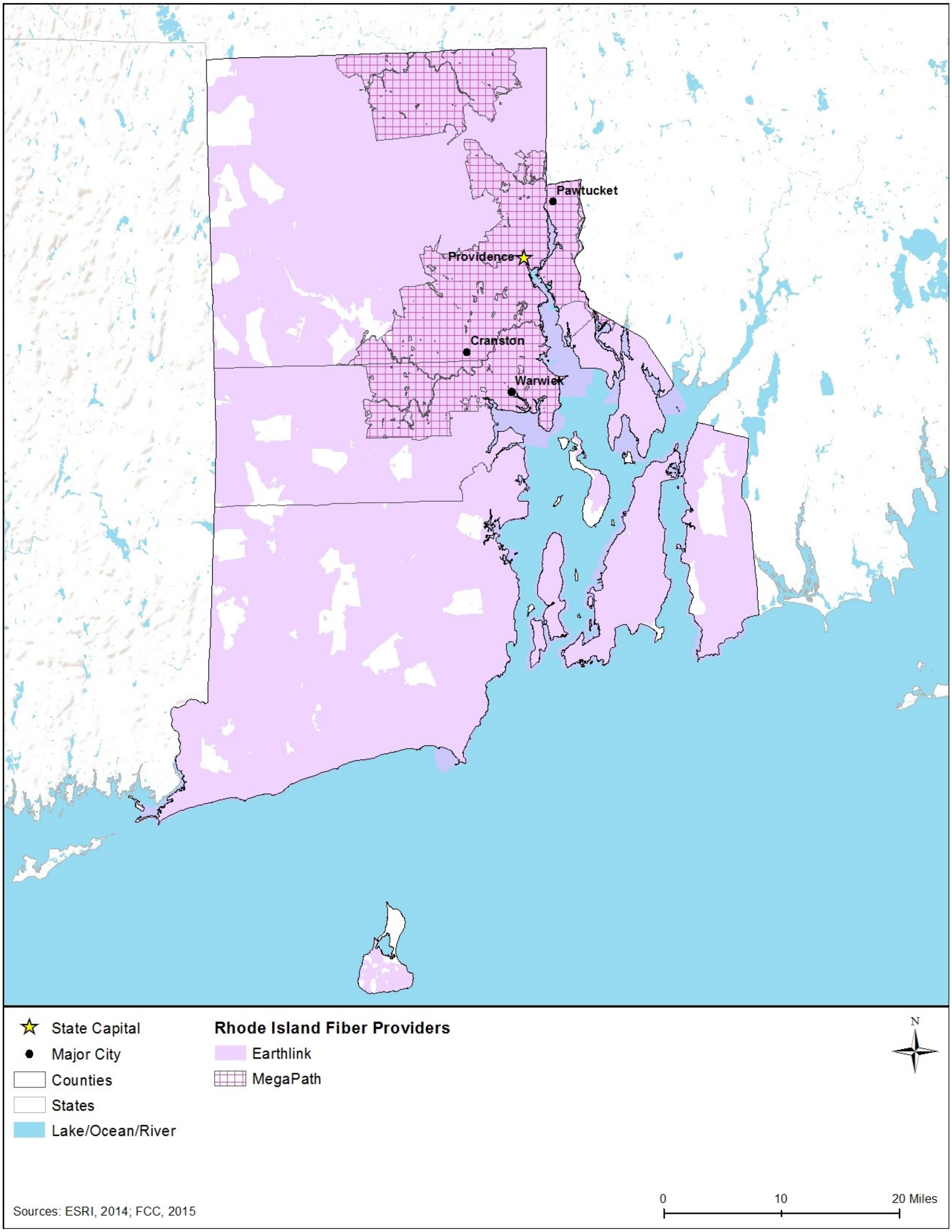


Figure 13.1.1-11: Earthlink and Megapath Fiber Availability in Rhode Island

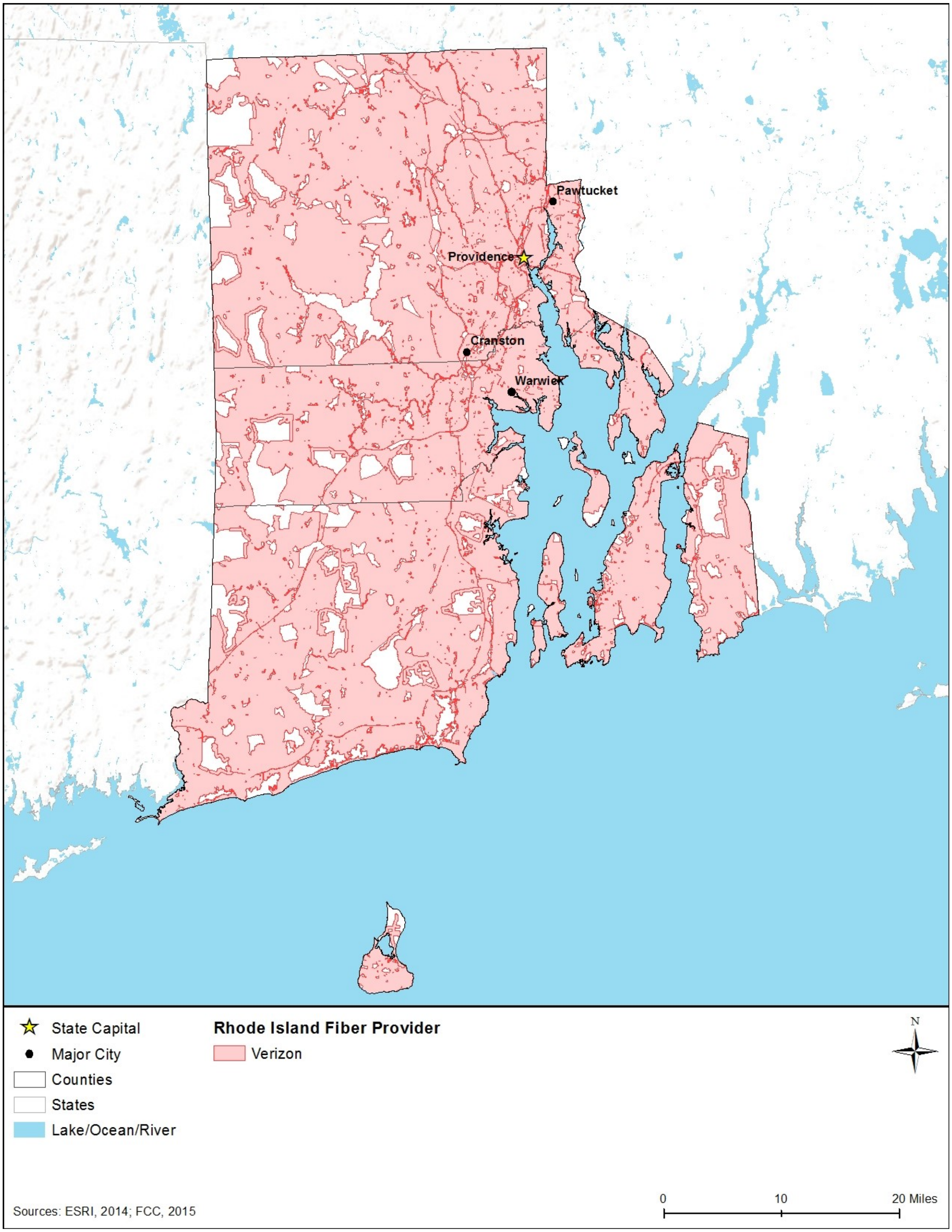


Figure 13.1.1-12: Verizon Fiber Availability in Rhode Island

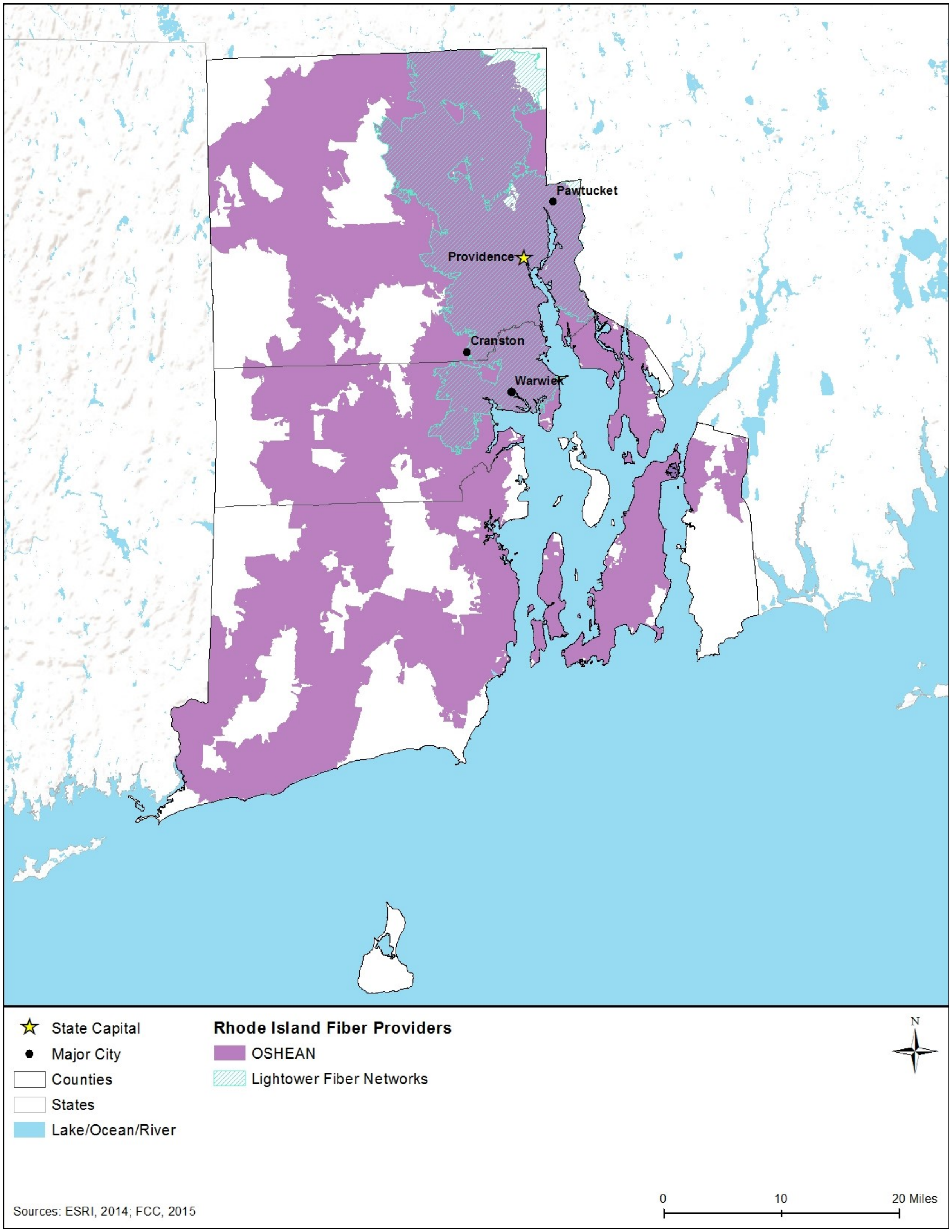


Figure 13.1.1-13: OSHEAN and Lightower Fiber Networks Fiber Availability in Rhode Island

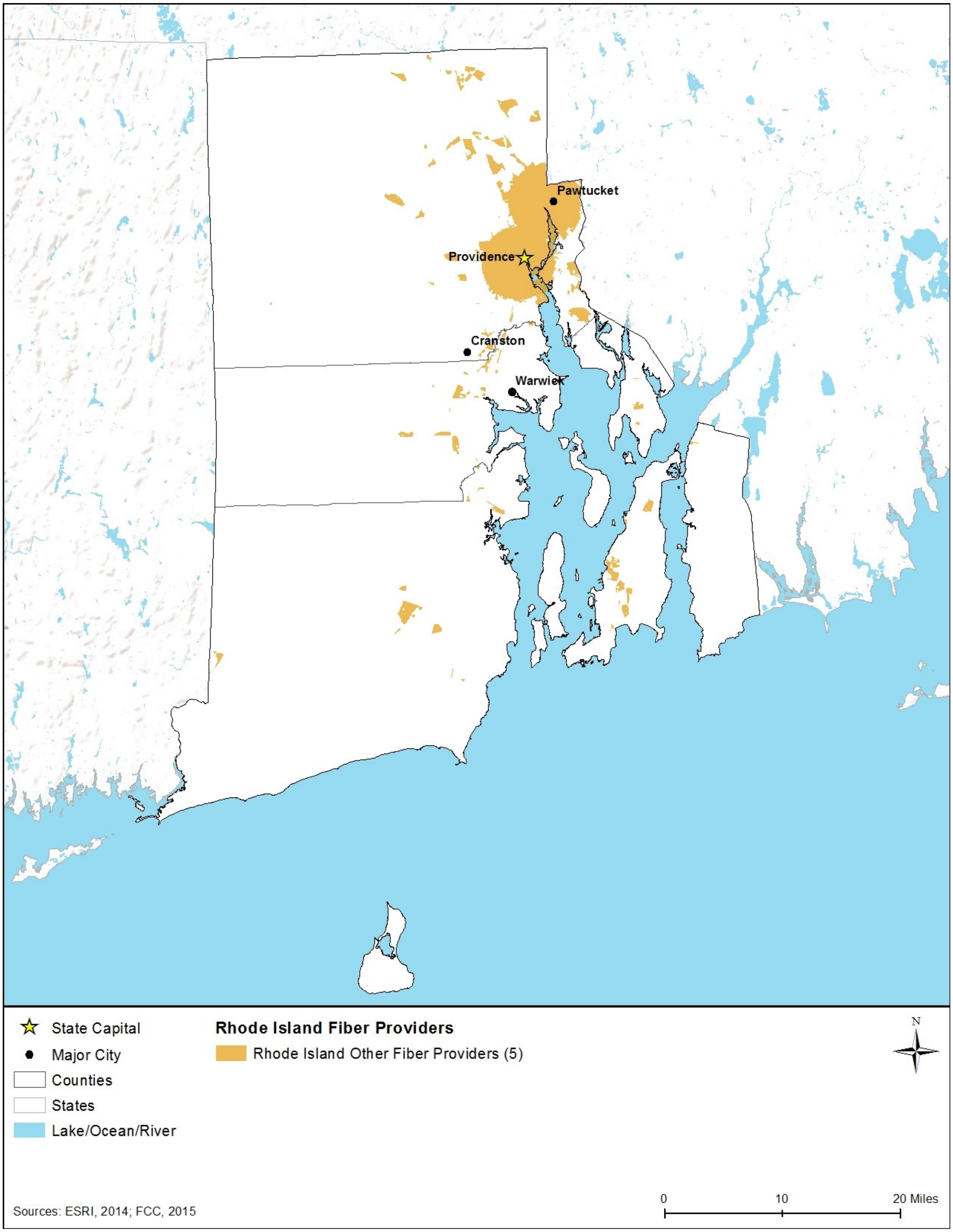


Figure 13.1.1-14: Other Provider Fiber Availability in Rhode Island

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).

13.1.1.6. 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 sewage. Section 13.1.4, Water Resources, describes the potable water sources in the state.

Electricity

Electricity utilities in Rhode Island are governed by the Public Utilities Commission. This body is made up of two smaller separate organizations: the Commission and the Division of Public Utilities and Carriers (RIPUC, 2015a). The Commission acts as a tribunal with the “jurisdiction, powers, and duties to implement and enforce the standards of conduct” (RIPUC, 2015b). The Division of Public Utilities and Carriers “exercises the jurisdiction, supervision, powers and duties not specifically assigned to the Commission, including the execution of all laws relating to public utilities and carriers and all regulations and orders of the Commission governing the conduct and charges of public utilities” (RIPUC, 2015c). Electricity in the state of Rhode Island can be obtained from multiple sources (RIPUC, 2015c). The Block Island Power Company operates on Block Island, which is 12 miles from the southern coast of Rhode Island (Block Island, 2015). Likewise, the Pascoag Utility District supplies electricity in Pascoag and nearby Harrisville, RI to approximately 5,000 customers (RIPUC, 2015d) (Pascoag Utility District, 2015). The third source is National Grid, a company that provides generation, transmission, and distribution services in Rhode Island (National Grid, 2015a). A number of other companies pay to use National Grid’s transmission and distribution equipment, and many buy electricity from National Grid to sell to consumers. There are 18 utilities in the National Grid territory that supply electricity to residential and commercial customers (National Grid, 2015b). There are also three companies that supply electricity only to commercial or industrial customers (National Grid, 2015c). In 2014 and 2015, Rhode Island’s primary source of electricity generation was natural gas (EIA, 2015a) (EIA, 2015b). In 2015, Rhode Island ranked as the 48th largest nationwide net generator of electricity of the 50 states, producing 438 thousand megawatt hours[10] (EIA, 2015c).

[10] A megawatt hour is defined as “One thousand kilowatt-hours or 1million watt-hours,” where a 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 hou.r” (EIA, 2016)

Water

Water Utilities in Rhode Island are regulated by the Public Utilities Commission and Division of Public Utilities and Carriers. This body regulates for-profit utility companies as well as municipal water systems that serve areas outside of their municipal boundaries. The City of Newport Water Department and the Pawtucket Water Supply Board are examples of utility boards that fall under the jurisdiction of the Commission (RIPUC, 2014b). Public water suppliers must submit a Consumer Confidence Report, an annual water quality report that is available for public viewing. Assessments of the quality of water at the source are performed by the Office of Drinking Water and the University of Rhode Island (RIDH, 2015).

Wastewater

The Public Utilities Commission and Division of Public Utilities and Carriers regulate two wastewater treatment facilities in the state, through the Narragansett Bay Commission (NBC) (RIPUC, 2014c). The NBC facilities are in Providence and in East Providence (Narragansett Bay Commission, 2015). In total, there are 19 major wastewater treatment facilities in the state treating approximately 100 million gallons of wastewater on a daily basis (RIDEM, 2013a). Each of these plants serves more than a thousand people, with most serving well over ten thousand people (RIDEM, 2014a). The Office of Water Resources approves design plans for the construction of facilities or systems, as well as inspecting existing facilities and issuing permits (RIDEM, 2013a). Facility operators are also regulated by the Office of Water Resources, with exams being offered in May, August, and December (RIDEM, 2015a).

Solid Waste Management

In Rhode Island, the disposal of solid waste is governed by the Office of Waste Management, which oversees and investigates reports of contaminated sites or faulty underground storage and regulates those facilities that handle solid and hazardous wastes, such as landfills or other facilities (RIPUC, 2015e). There are 56 active facilities in the state that receive, process, store, or dispose of solid, medical, or hazardous waste. Of these, 5 are licensed landfills, 27 are hold transfer station licenses, 2 are licensed to deal with construction and demolition debris, and 14 are registered to handle leaf and yard waste (RIDEM, 2015b). Most types of electronic wastes are not accepted by most disposal sites in Rhode Island. State law mandates that electronics manufactures have “individual financial responsibility to take back and recycle their products at the end of the product's useful life from both households and public/private elementary and secondary schools” (RIDEM, 2015c).

13.1.2. Soils

13.1.2.1. 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.

13.1.2.2. 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. A list of applicable state laws and regulations is included in Table 13.1.2-1 below.

Table 13.1.2-1: Relevant Rhode Island Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Soil Erosion and Sediment Control Act (Rhode Island General Laws [RIGL] 45-46)	Rhode Island Department of Environmental Management (RIDEM)	Requires a Soil Erosion and Sediment Control Plan for any project subject to the RI Storm water Design and Installation Standards Manual – Minimum Standard 10

Source: (State of Rhode Island General Assembly, 2015)

13.1.2.3. Environmental Setting

Rhode Island is composed of two Land Resource Region (LRR),[11] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006): Long Island-Cape Cod Coastal Lowland Region and New England and Eastern New York Upland, Southern Part.

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

Within and among Rhode Island's two LRRs are two Major Land Resource Areas (MLRA),[12] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming. The locations and characteristics of Rhode Island's MLRAs are presented in Figure 13.1.2-1 and Table 13.1.2-2.

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

[12] 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).
[13] The flora and fauna of a region.
[14] Expansive soils are characterized by “the presence of swelling clay materials” that absorb water molecules when wet and expand in size or shrink when dry leaving “voids in the soil.” (Rogers, Olshansky, & Rogers, 2004).
[15] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength. (USFS, 2009b)

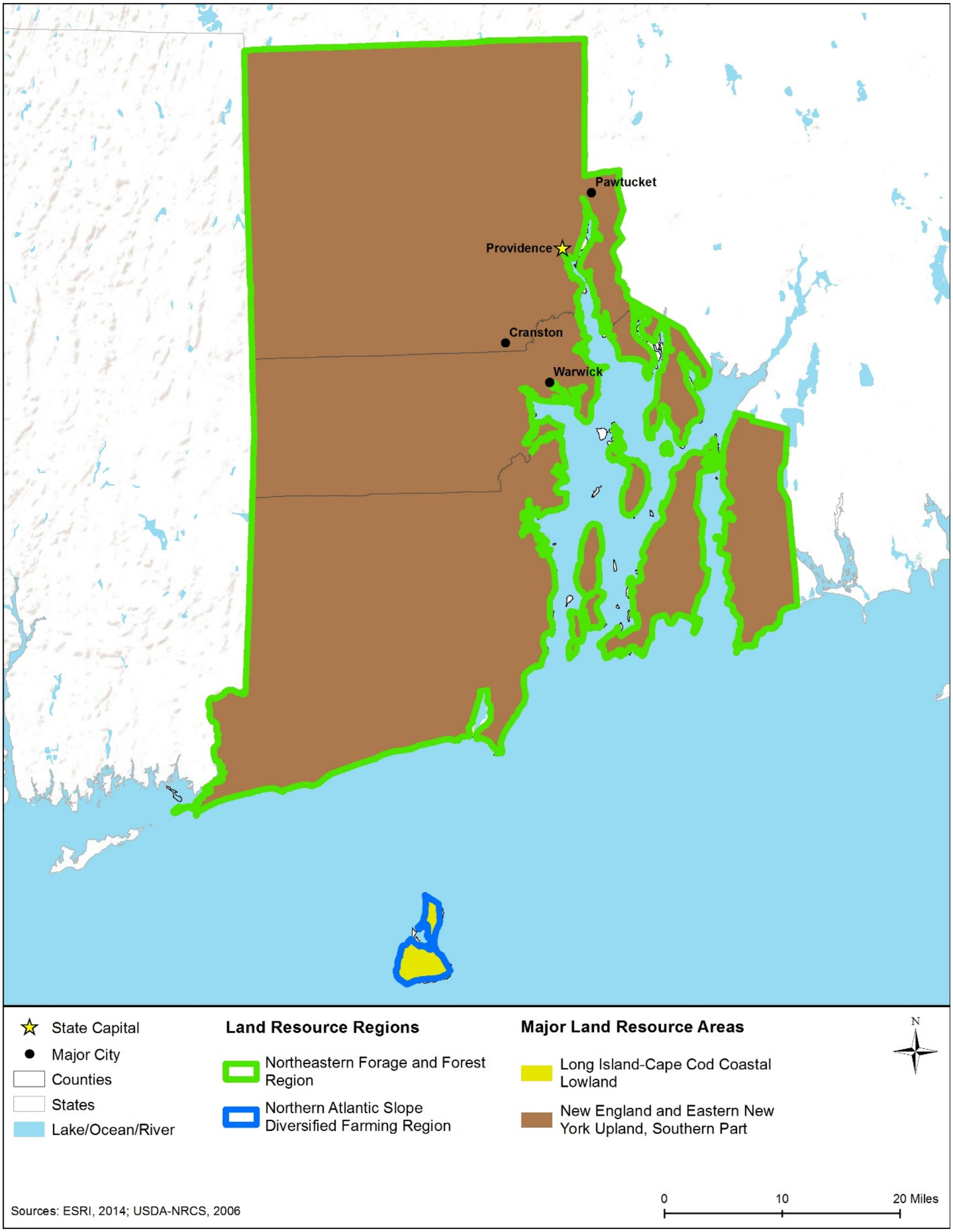


Figure 13.1.2-1: Locations of Major Land Resource Areas in Rhode Island

Table 13.1.2-2: Characteristics of Major Land Resource Areas in Rhode Island

MLRA Name	Region of State	Soil Characteristics
Long Island-Cape Cod Coastal Lowland	Block Island	Dominant soil orders are Inceptisols[a] and Entisols.[b] The soils in this area are deep, with a moderately coarse texture or coarse texture, nearly level to sloping, and well drained.
New England and Eastern New York Upland, Southern Part	All of Rhode Island except for Block Island	Dominant soil orders in this MLRA include Entisols, Histosols,[c] and Inceptisols, and the soils are generally very deep, somewhat excessively drained to poorly drained, and loamy or sandy.

Source: (NRCS, 2006)

[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% of the world's ice-free land surface." (NRCS, 2015b)

[b] Entisols: "Soils that show little to no pedogenic horizon development. They occur in areas of recently deposited parent materials or in dunes, steep slopes, or flood plains where erosion or deposition rates are faster than rate of soil development. They make up nearly 16% of the world's ice-free land surface." (NRCS, 2015b)

[c] Histosols: "Soils that have a high content of organic matter and no permafrost. Also known as bogs, moors, peats, or mucks, these soils are saturated year round and form in decomposed plant remains. If exposed to air and drained, the microbes will decompose and the soils can subside dramatically. They make up nearly 1% of the world's ice-free land surface." (NRCS, 2015b)

13.1.2.4. 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[16]; there are 12 soil orders in the world and they are characterized by both observed and inferred[17] 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 STATSGO2[18] soil database identifies four different soil suborders in Rhode Island (NRCS, 2015d). Figure 13.1.2-2 depicts the distribution of the soil suborders, and Table 13.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[16] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2013a).
[17] "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, 2015c)
[18] STATS2GO is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map is comprised of general soil association units and is maintained and distributed as a spatial and tabular dataset.

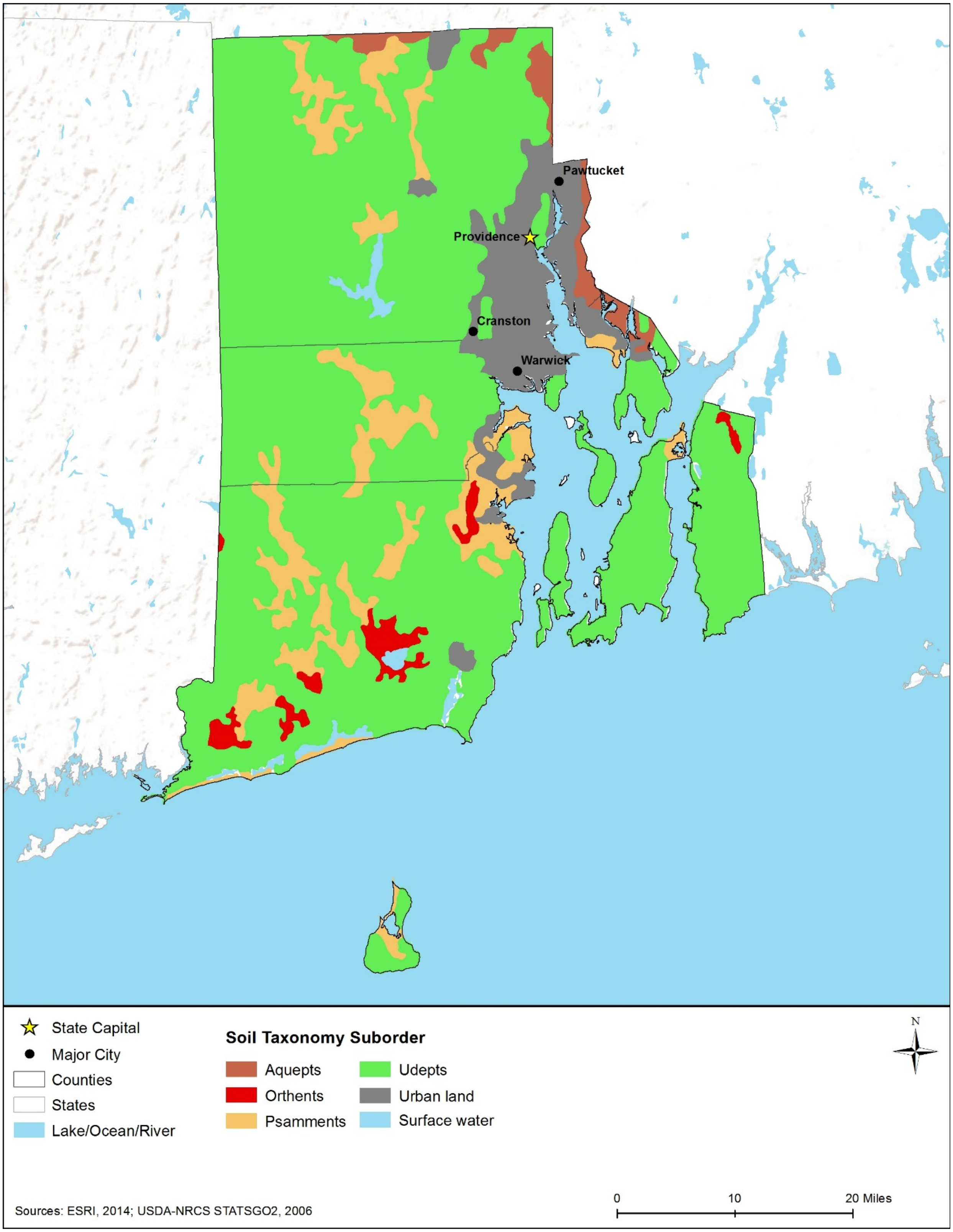


Figure 13.1.2-2: Rhode Island Soil Taxonomy Suborders

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Table 13.1.2-3: Major Characteristics of Soil Suborders Found in Rhode Island, as depicted in Figure 13.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[a]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
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.	Loamy sand, silt loam	0-3	Very poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Loamy fine sand	3-8	Excessively drained	No	A	Low	High	Low	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.	Loamy sand, sand	0-8	Excessively drained	No	A	Low	High	Low	Low
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, fine sandy loam, gravelly loam, gravelly loamy sand, loam, silt loam, unweathered bedrock	0-25	Moderately well drained to well drained	No	B, C	Medium	Moderate, Low	Medium	Low

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

[a] 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).

[b] Based on Runoff Potential, described in Section 13.5.3.2

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13.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[19] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 13.1.2-3 (above) provides a summary of the runoff potential for each soil suborder in Rhode Island.

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

Group B. Silt loam or loam soils. This group of soils has a "moderate infiltration rate when thoroughly wetted and consists chiefly of 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. Udepts fall into this category in Rhode Island.

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

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

13.1.2.6. 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 13.1.2-3 (above) provides a summary of the erosion potential for each soil suborder in Rhode Island. Soils with the highest erosion potential in

[19] Classifying soils is highly generalized and it is challenging to differentiate orders as soil properties can change with distance or physical properties. The soil suborders are at a high level, therefore soil groups may be found in multiple hydrologic groups within a state, as composition, topography, etc. varies in different areas.
[20] Infiltration Rate: "The rate at which a soil under specified conditions absorbs falling rain, melting snow, or surface water expressed in depth of water per unit time." (FEMA, 2010)

Rhode Island include those in the Aquepts and Udepts suborders, which are found throughout most of the state (Figure 13.1.2-2).

13.1.2.7. 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 10 tons can cause soil compaction of greater than 12 inches depth (NRCS, 1996b), (NRCS, 2003).

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS, 1996b). Table 13.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Rhode Island. Soils with the highest potential for compaction and rutting in Rhode Island include those in the Aquepts suborder, which are found in northern and eastern areas of the state (Figure 13.1.2-2).

13.1.3. Geology

13.1.3.1. 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 ground-water availability. Several of these elements are discussed in other sections of this PEIS, including Water Resources (Section 13.1.4), Human Health and Safety (Section 13.1.15), and Climate Change (Section 13.1.14).

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

- Section 13.1.3.3, Environmental Setting: Physiographic Regions and Provinces[21],[22]
- Section 13.1.3.4, Surface Geology
- Section 13.1.3.5, Bedrock Geology[23]
- Section 13.1.3.6, Paleontological Resources[24]
- Section 13.1.3.7, Fossil Fuel and Mineral Resources

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

- Section 13.1.3.8, Geologic Hazards[25]

13.1.3.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Geology, such as the National Historic Preservation Act and the Clean Water Act, are detailed in Appendix C. A list of applicable state laws and regulations is included in Table 13.1.3-1 below.

Table 13.1.3-1: Rhode Island Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Rhode Island State Building Code (SBC) - 1 (2013)	Department of Administration	Provisions for earthquake-resistant design
Rhode Island Load Resistance Factor Design (LRFD) Bridge Design Manual (2007)	Rhode Island Department of Transportation	Bridges must be designed with consideration of seismic motion

Sources: (State of Rhode Island, 2013) (RIDOT, 2007)

13.1.3.3. Environmental Setting: Physiographic Regions and Provinces

The concept of physiographic regions was created in 1916 by geologist Nevin Fenneman as a way to describe areas of the United States based on common landforms (i.e., not climate or vegetation). Physiographic regions are areas of distinctive topography, geography, and geology. "Important physiographic differences between adjacent areas are, in a large proportion of cases, due to differences in the nature or structure of the underlying rocks." 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 local scale (Fenneman, 1916).

Rhode Island is almost entirely within the Appalachian Highlands Physiographic Region and the New England Province; a small portion of Rhode Island falls within the Atlantic Plain Region and Coastal Plain Province (Fenneman, 1916) (Figure 13.1.3-1). To characterize differences in physiography across the state and to better support PEIS tiering, the three physiographic sections of the New England Province in Rhode Island are summarized below.

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

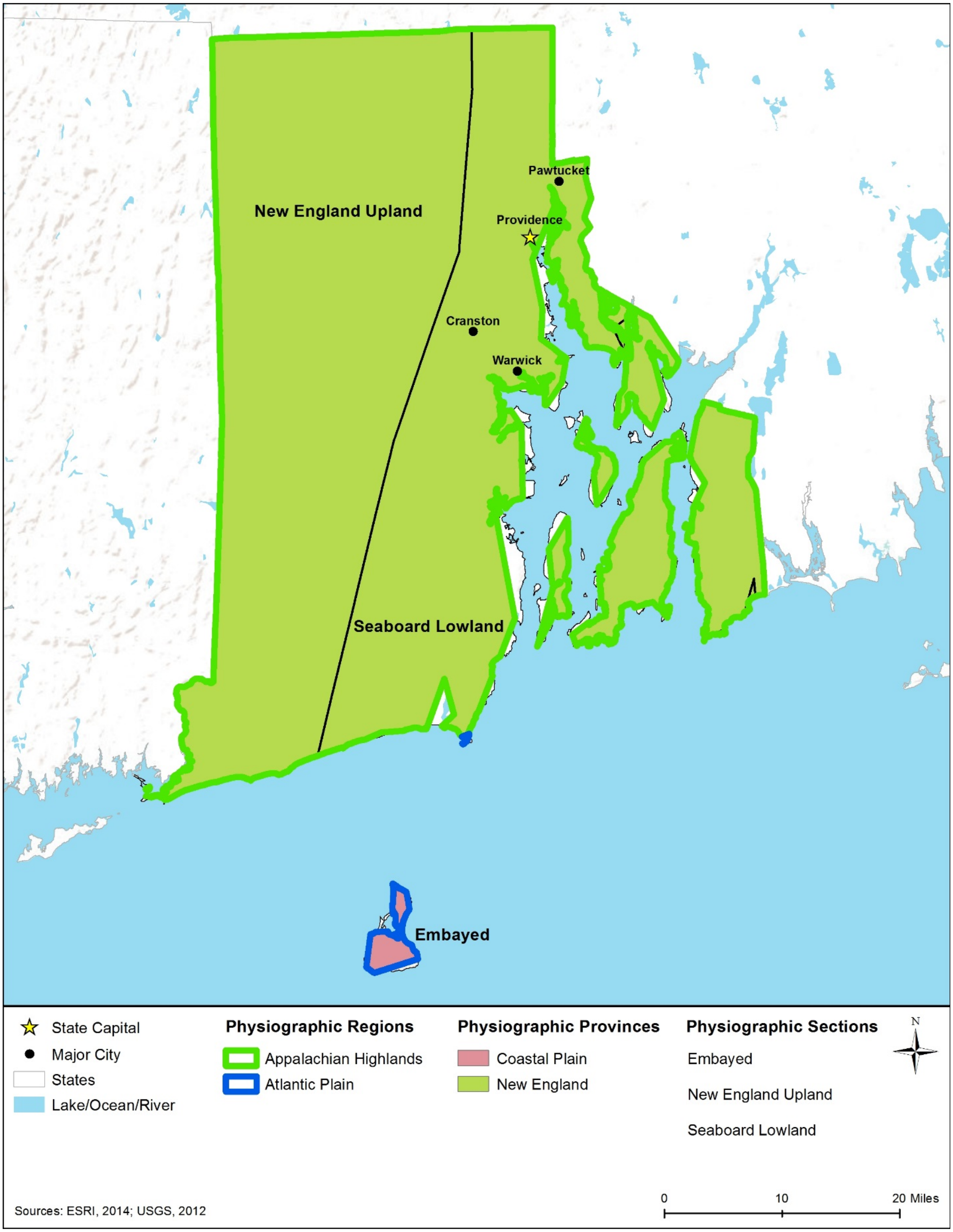

Figure 13.1.3-1: Physiographic Regions, Provinces, and Sections of Rhode Island

Atlantic Plain Region

The Atlantic Plain Region includes the Continental Shelf and the Gulf and Atlantic Coast plains stretching from New York to Texas. The Atlantic Plain Region formed through the repetitive rise and fall of the oceans over the last 150 million years. 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. Sedimentary strata are thin in the western side of the region, and thicken to several thousand feet along the coast. The Atlantic Plain is characterized by gentle topography and a transition zone between the land and sea often having marshes, lagoons, swamps, sand bars, and reefs (NPS, 2015a).

Within Rhode Island, the Atlantic Plain Region (and Coastal Plain Province/Embayed section) is confined to Block Island, 20 miles off the southern coast of the state (USGS, 1999a). Block Island, which is approximately 7 miles long by about 3.5 miles wide, constitutes a portion of the remains from the terminal moraine[26] from the most recent Ice Age, which ended about 13,000 years ago. Block Island was once connected to the mainland but other portions of the moraine have since been eroded. Block Island "is composed of loose glacial deposits and a small amount of other unconsolidated or weakly consolidated and sedimentary rock; bedrock lies far below the surface and is little exposed" (Rhode Island Historical Preservation and Heritage Commission, 1991).

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).

As reported above, the Appalachian Highlands Region within Rhode Island is composed of one physiographic province: the New England Province (USGS, 2003a).

The New England Province includes all of Rhode Island, with the exception of Block Island, and spans from southern Canada southwestward through New York and New Jersey; the province's physiographic characteristics are reflective of areas that have been impacted by glaciation to include features such as kames[29] and eskers.[30] Glacial deposits are patchy throughout the province. Topography is flat with the exception of sporadic hills and mountains. The surface

[26] Moraine: "A general term for unstratified and unsorted deposits of sediment that form through the direct action of, or contact with, glacier ice." (USGS, 2004)
[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, 2014a)
[28] The Rocky Mountains exceed 14,000 feet above sea level (NPS, 2004).
[29] Kame: "A sand and gravel deposit formed by running water on stagnant or moving-glacier ice." (USGS, 2004)
[30] Esker: "A meandering, water-deposited, generally steep-sided sediment ridge that forms within a subglacial or englacial stream channel." (USGS, 2004)

elevation decreases toward the southeast, from maximum inland altitudes around 2,200 feet ASL, to sea level at the Atlantic Ocean (USGS, 1999a).

Within Rhode Island, the New England Province is subdivided into two sections, which split the state into eastern and western areas: New England Upland section (western) and Seaboard Lowland section (eastern). The New England Upland section has rolling hills with elevations ranging from below 1,000 feet to above 2,000 feet ASL. The New England Upland Province section is a broad plateau interspersed with narrow valleys. At 400 to 500 feet ASL, the boundary between the New England Upland Section (which is comprised of the western portion of Rhode Island) and the Seaboard Lowland (which is comprised of the eastern portion of Rhode Island) bisects the state into eastern and western halves. The Seaboard Lowland is much lower in elevation than the New England Uplands to the west. Topographic relief is generally less than 200 feet. The topography is tilted toward the southeast with most waterbodies draining in that direction toward the Atlantic Ocean (USGS, 1999a).

13.1.3.4. Surface Geology

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

The Rhode Island coastline is dominated by "headlands of low-relief igneous rocks and embayments of more deeply eroded sedimentary and metamorphic rocks." Weathered sediments from the Appalachian Mountains are not evident in Rhode Island, likely due to glaciation during the Ice Age during which glaciers extended to the modern coastline. Offshore deposits from the most recent glaciation are found at Block Island, RI (off the southern coast of the state), where moraines were deposited roughly 21,000 years ago. Figure 13.1.3-2 provides a representation of the surface deposits in Rhode Island (Kelley, 2015).

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

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

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

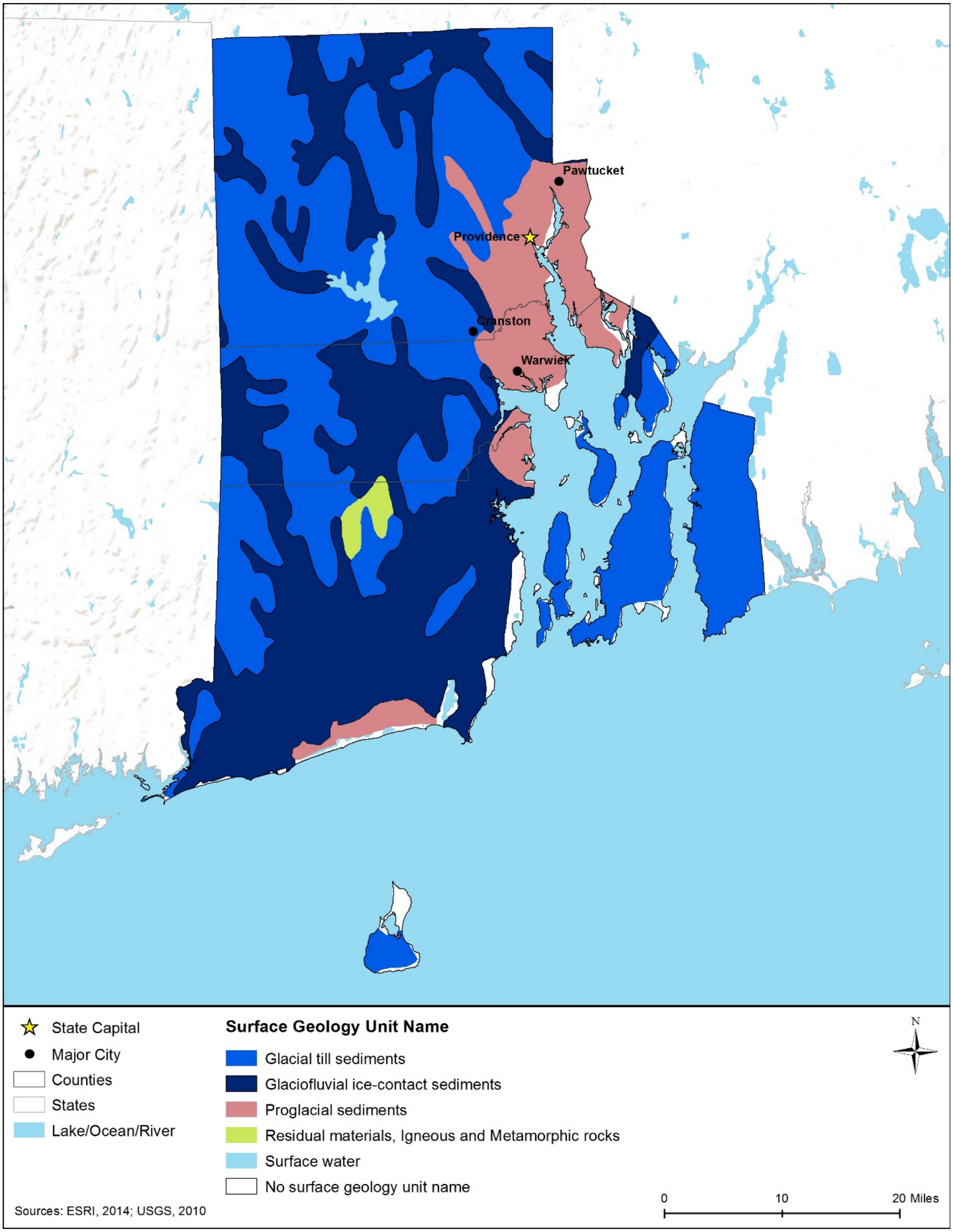

Figure 13.1.3-2: Generalized Surface Geology for Rhode Island

13.1.3.5. 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),[34] rock composition, and regional tectonism.[35] 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).

Within Rhode Island, the Appalachian Mountains have undergone multiple cycles of "sedimentation and volcanism, folding, thrust faulting,[36] metamorphism,[37] plutonism,[38] uplift, and erosion." Most of Rhode Island's bedrock exhibits the effects of having experienced multiple tectonic events (e.g., some locations contain rocks that underwent compression followed by tension). Sedimentation and mountain building occurred between 540 and 440 MYA, and may have occurred before that. The Narragansett basin (in eastern Rhode Island) contains the only known Pennsylvanian (318 to 299 MYA) rocks in the area (Quinn, 1971)

Rocks in Rhode Island can be categorized into six groups (Quinn, 1971):

1. Older metamorphic rocks from the Precambrian and early Paleozoic Eras (4,600 to 450 MYA)
2. Older plutonic rocks from the middle Paleozoic Era (approx. 540 to 360 MYA)
3. Igneous rocks from the Mississippian Period (359 to 318 MYA)
4. Sedimentary rocks in the Narragansett Basin from the Pennsylvanian Period (318 to 299 MYA)
5. Pennsylvanian and post-Pennsylvanian granites (younger than 299 MYA)
6. Cretaceous Period (146 to 66 MYA) clay and sand exposed on Block Island

Figure 13.1.3-3 depicts the generalized bedrock geology for Rhode Island.

[34] 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)
[35] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust." (USGS, 2014b)
[36] Thrust Fault: "A reverse fault with a dip of 45 degrees or less." (USGS, 2012a)
[37] Metamorphism: "Rocks [that] started out as some other type of rock, but have been substantially changed from their original igneous, sedimentary, or earlier metamorphic form. Metamorphic rocks form when rocks are subjected to high heat, high pressure, hot, mineral-rich fluids or, more commonly, some combination of these factors." (USGS, 2015d)
[38] Pluton: "A large body of intrusive igneous rock that solidified within the crust." (USGS, 2014b)

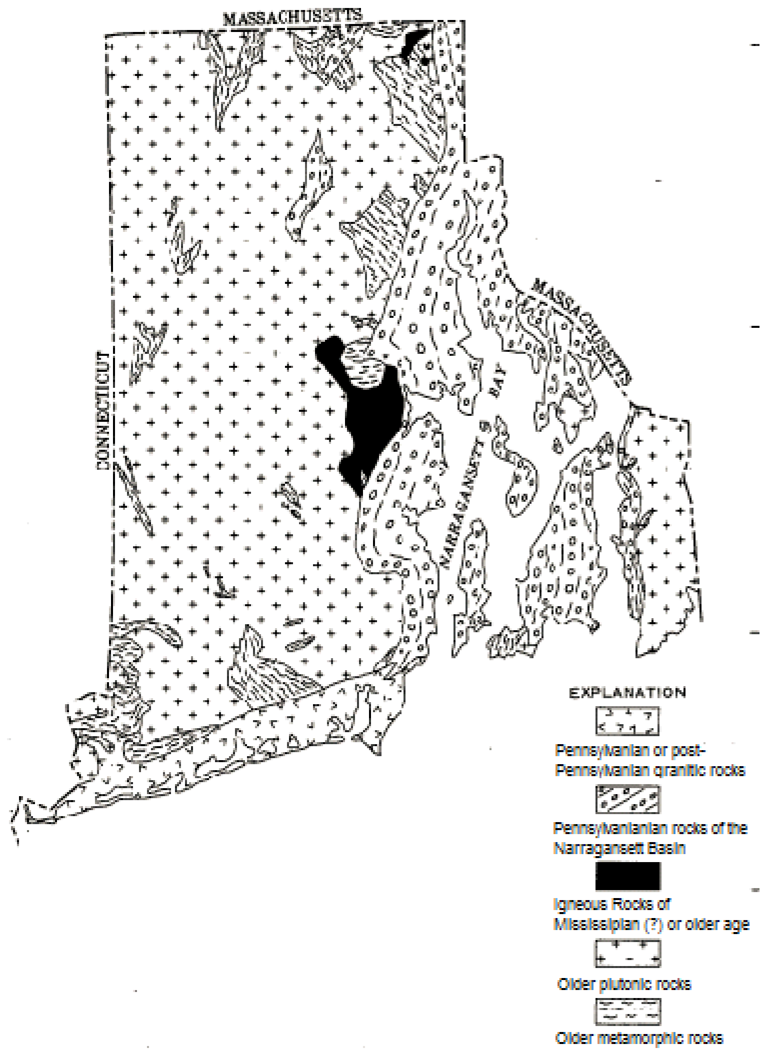

Figure 13.1.3-3: Generalized Bedrock Geology of Rhode Island

Source: (USGS, 1971)

13.1.3.6. Paleontological Resources

Fossils are scarce in Rhode Island, with only plant fossils recorded in the state. During the Paleozoic Era (542 to 251 MYA), sediments from rivers and streams poured into a basin that had formed in the eastern part of Rhode Island (what is now known as Narragansett Bay), creating a low lying swamp and leaving behind remnants of coal layers and fragments of fossil plants (Paleontology Portal, 2015). These plant fossils can be found in and around the Narragansett Basin in coal-bearing formations, including the Rhode Island formation (USGS, 2014c) and include calamites,[39] annularia,[40] and ferns (Round, 1924). There is no state fossil designated for Rhode Island (NPS, 2010).

[39] Calamites: "[Horsetails that] were up to 9m tall and 30 cm *in diameter."* (Thomas, 2000)
[40] Annularia: "The leaf whorls of an extinct horsetail. (Illinois State Museum, 1995)

13.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

Rhode Island does not produce petroleum or natural gas. The state relies on its major port, the Port of Providence, for the import of petroleum products. The majority of Rhode Island's natural gas is transported to the state via pipeline from New York via Connecticut (EIA, 2015d). For additional information on Rhode Island's infrastructure, refer to Section 13.1.1.

Minerals

As of 2015, Rhode Island's nonfuel mineral production was valued at $70M, ranking 49th (by monetary value) nationwide for total nonfuel production; this accounts for less than 0.1 percent the country's non-fuel mineral production. As of 2011, Rhode Island's leading nonfuel mineral commodities were construction sand and gravel, crushed stone, and gemstones (USGS, 2016).

13.1.3.8. Geologic Hazards

The three major geologic hazards of concern in Rhode Island are earthquakes, landslides, and subsidence. Volcanoes do not occur in Rhode Island and therefore do not present a hazard to the state (USGS, 2015e). The sub-sections below summarize current geologic hazards in Rhode Island.

Earthquakes

Between 1973 and March 2012, there were five earthquakes in Rhode Island ranging from 2.5 to 3.5 on the Richter scale (USGS, 2014d). 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, 2012b).

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 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" (Oregon Department of Geology, 2015). Subduction zones are found off the coast of Washington, Oregon, and Alaska (USGS, 2014e). 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). Rhode Island is located far from any convergence boundaries, but is located in the middle of a tectonic plate (Kafka, 2014).

Figure 13.1.3-4 depicts the seismic risk throughout Rhode Island. 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.[41] (USGS, 2010)

Seismic risk is low throughout the state. The largest earthquake recorded in Rhode Island was a magnitude 3.5 quake in March 1976, near the city of Newport. This earthquake was also felt in portions of Massachusetts (USGS, 2012c). More recently, a magnitude 2.0 quake occurred in February 2015, also near Newport (Pattani, 2015). Rhode Island has also experienced shaking from earthquakes centered in Quebec (Canada), New Hampshire, and New York (USGS, 2015f).

Landslides

According to the USGS landslide incidence and susceptibility map (Figure 13.1.3-5), mainland Rhode Island is at minimal risk to experiencing widespread regional landslides (USGS, 2014f). "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).

Several landslides have been documented on Block Island, which represents the terminal moraine[42] of the Wisconsinan glaciation period. The image at right displays a photo of one landslide event on Block Island. Coastal landslides on Block Island are largely attributed to erosion by ocean currents and waves (Kelley, 2015).

Block Island Bluff Landslide

Source: (Kelley, 2015)

[41] Post-1985 buildings (in California) have experienced only minor damage with shaking of 60% g. (USGS, 2010)

[42] Terminal moraine is glacial sediment that is deposited by a glacial retreat "near the maximum extension of the glacier." (Reineck, 2012)

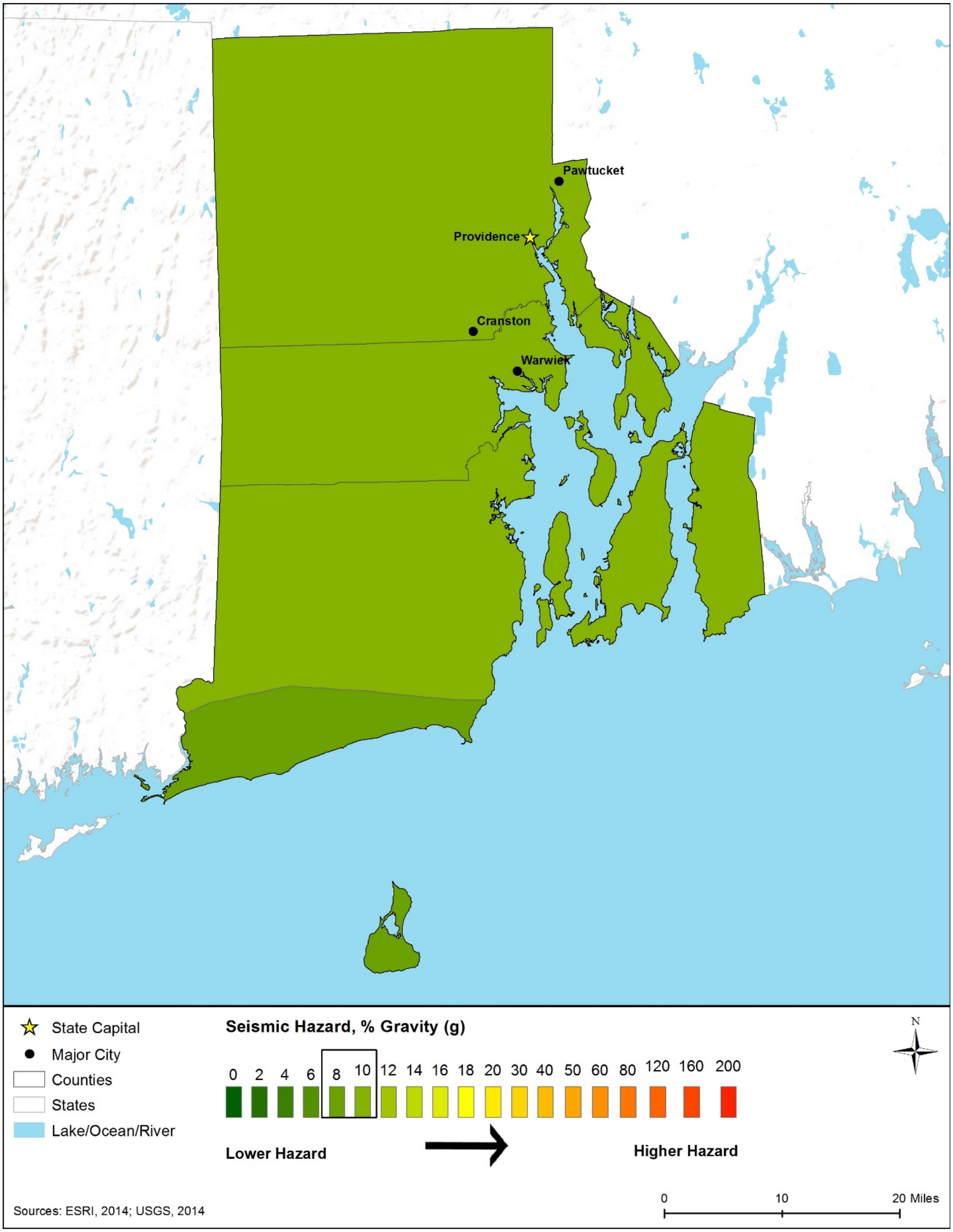

Figure 13.1.3-4: Rhode Island 2014 Seismic Hazard Map

Figure 13.1.3-5: Rhode Island Landslide Incidence and Susceptibility Hazard Map[43]

[43] Susceptibility hazards not indicated in Figure 13.1.3-5 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 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, 2014g)

Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000). 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 (USGS, 2013b). 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 can cause ground layers collapse on one another. Compression permanently lowers 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. Changes in ground-surface elevation not only affect the integrity and operation of existing infrastructure, but also complicate vegetation and best management of land use (USGS, 2013b).

"Sea level rise along most of the coastal Northeast is anticipated to exceed the global average rise due to local land subsidence" (The White House -- Office of the Press Secretary, 2014). Statewide, Rhode Island is subsiding at a minimum of 6 inches per 100 years (Rhode Island Coastal Resources Management Program, 2013). Studies indicate that changes in ocean circulation may contribute to Rhode Island's relative sea level rise (Rhode Island Coastal Resources Management Program, 2013). Offshore gauges near Newport have recorded relative sea level rise at 2.69 millimeters per year (Rhode Island Coastal Resources Management Program, 2013).

13.1.4. Water Resources

13.1.4.1. Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine waters, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 13.1.5). 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, 2014h)

13.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C. Table 13.1.4-1 summarizes the major Rhode Island laws and permitting requirements relevant to the state's water resources.

Table 13.1.4-1: Relevant Rhode Island Water Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Protection of Waters	RIDEM	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 DEM indicating that the proposed activity will not violate water quality standards.
Rhode Island Pollutant Discharge Elimination System (RIPDES) program	RIDEM	Point source discharges[a] of wastewater into surface or groundwater, including the intake and discharge of water for cooling purposes, stormwater discharge, and construction activities that disturb one or more acres require a RIPDES permit.

Source: (RIDEM, 2008a)

[a] Point source discharges come directly from an identified source, such as a sewer or pipe (USEPA, 2014d)

13.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams, as well as estuarine[44] and coastal waters. There are approximately 1,420 miles of rivers and streams and 20,749 acres of lakes, ponds, and reservoirs. Estuaries cover approximately 159 square miles, and include Narragansett Bay and the coastal ponds. Designated uses of these surface waters include "drinking water, recreation, habitat and commerce." (RIDEM, 2008a)

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). Rhode Island's waters (lakes, rivers, and streams) are divided into five major watersheds, or drainage basins (Figure 13.1.4-1). Rhode Island Appendix A, Table A-1, provides detailed information on the state's major watersheds, as defined by RIDEM. Visit www.dem.ri.gov/programs/bpoladm/suswshed/ for more information.

The Blackstone Watershed lies along the northern border of Rhode Island draining areas around Clear River and Branch River in the northwest to the Blackstone River in the northeast. The Pawcatuck Watershed covers the majority of southwest Rhode Island extending from the state's western border to the Narragansett Bay watershed. The watershed "runs through rural uplands, woodlands, forests, and small towns" within Rhode Island and discharges into the estuary at Westerly, Rhode Island (RICRMC, 2015). The Quinebaug Watershed borders the Blackstone,

[44] 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)

Narragansett Bay, and Pawcatuck watersheds to the west. The majority of its drainage area includes hills that span the northwestern border of Rhode Island (Wild & Nimiroski, 2007). The Narragansett Bay Watershed covers central and southeast Rhode Island including coastal land along the bay and islands within the bay area. The Cape Cod Watershed is located in the southeastern corner of Rhode Island and is mostly undeveloped land (RIDEM, 1998).

Freshwater

As shown in Figure 13.1.4-1, there are 10 major rivers in Rhode Island: Blackstone River, Branch River, Pawcatuck River, Pawtuxet River, Ponaganset River, Providence River, Sakonnet River, Usquepaug River, Wood River, and Woonasquatucket River. The Pawtuxet River flows through central Rhode Island and empties into the Providence River, draining the central part of the state. The Pawcatuck River flows west across the southern part of the state into Block Island Sound, south of the Rhode Island town of Westerly. The Blackstone River and its tributaries drain the northern portion of the state. The river flows southeast from Massachusetts to the northeast corner of Rhode Island, eventually becoming Seekonk River. Lakes, ponds, and reservoirs are distributed throughout the state. Rhode Island currently monitors the water quality of 237 freshwater lakes, ponds, and reservoirs that cover approximately 18,800 acres. Small ponds cover the remaining 1,800 acres. Four lakes in Rhode Island exceed 500 acres, but most are 50 acres or less in size and are artificial. (RIDEM, 2014b)

Major lakes and reservoirs in the state include the Flat River Reservoir, Worden Pond, and the Scituate Reservoir, as shown in Figure 13.1.4-1.

- Flat River Reservoir, also known as Johnson's Pond, is in northcentral Rhode Island, and is approximately 660 acres in size. The reservoir was created by damming the south branch of the Pawtuxet River. Main uses of the reservoir include municipal water and recreation (RIRC, 2015).
- Worden Pond is a freshwater lake in southeastern Rhode Island approximately 1,051 acres in size. It is the largest natural lake in the state and is sits between the Chipuxet and River and Pawcatuck River (RIDEM, 2014b). Worden Pond is an ideal habitat for fish as its shallow waters promote heavy weed growth. Residents and visitors use the lake for recreational purposes, such as fishing and watercraft activities. (RIDEM, 2012a)
- Scituate Reservoir is approximately 2,000 acres in size and the largest inland body of water in Rhode Island. The lake was formed by an earth-filled dam spanning the North Branch of the Pawtuxet River. The Scituate Reservoir is a primary source of drinking water for more than 60 percent of the state's residents and businesses (RIDEM, 2015d).

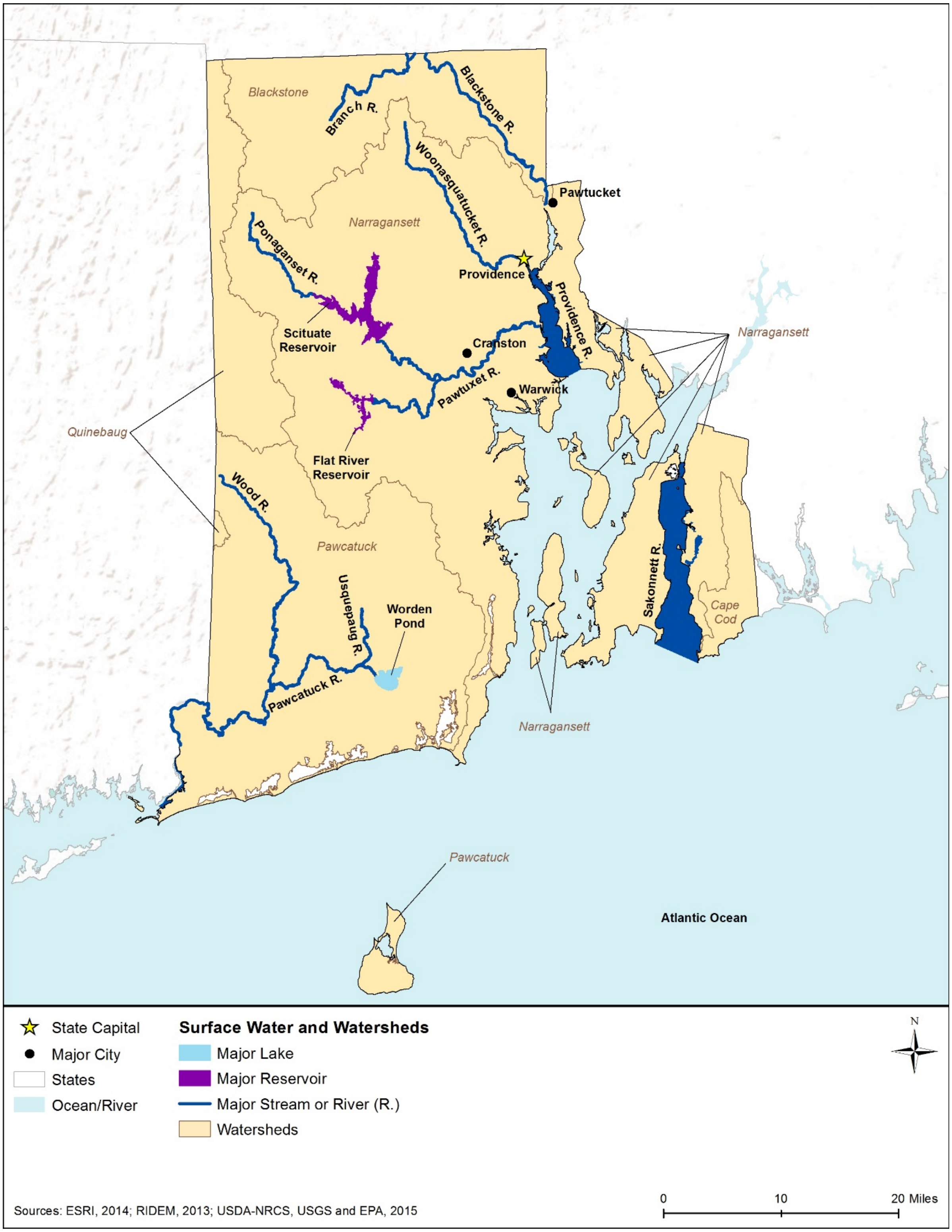

Figure 13.1.4-1: Major Rhode Island Watersheds, defined by RIDEM, and Surface Waterbodies

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 Rhode Island, from ocean waves and storms. Rhode Island’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)

Rhode Island’s total coastal area encompasses approximately 159 square miles of estuaries, and over 400 miles of coastline, including the state’s bays, coves, and offshore islands (State of Rhode Island, 2015b) (RIDEM, 2008a) (RIDEM, 2015e). Estuarine and coastal waters provide recreational areas for boating, swimming, hiking, bird watching, and other activities. Information on Rhode Island’s estuarine and coastal waters is available on the Rhode Island Coastal Resources Management Council site (www.crmc.ri.gov/).

There are two major estuaries in Rhode Island, as shown in Figure 13.1.4-2.

- The **Narragansett Bay Estuary** covers approximately 147 square miles of water surface, and its watershed encompasses approximately 740 square miles within Rhode Island. Narragansett Bay includes the Sakonnet River, Mount Hope Bay, and the southern tidal portion of the Taunton River, and opens to the Rhode Island Sound and Atlantic Ocean (NEIWPCC, 2015). In 1987, the USEPA’s National Estuary Program (NEP) recognized the Narragansett Bay as an Estuary of National Significance (USEPA, 2014b). The Narragansett Bay Estuary’s Comprehensive Conservation and Management Plan (CCMP) identifies the following goals: protect and restore clean water, manage land for conservation and community, protect and restore fish, wildlife, and habitats, and manage climate change impacts to human and natural systems (NBEP, 2012). For more information on the Narragansett Bay Estuary and CCMP, visit the USEPA's NEP website at www.water.epa.gov/type/oceb/nep/index.cfm#tabs-2.
- **Mount Hope Bay** is a tidal estuary within the Narragansett Bay and forms the northeastern arm of the Narragansett Bay Estuary at the mouth of the Taunton River on the Massachusetts/Rhode Island border.

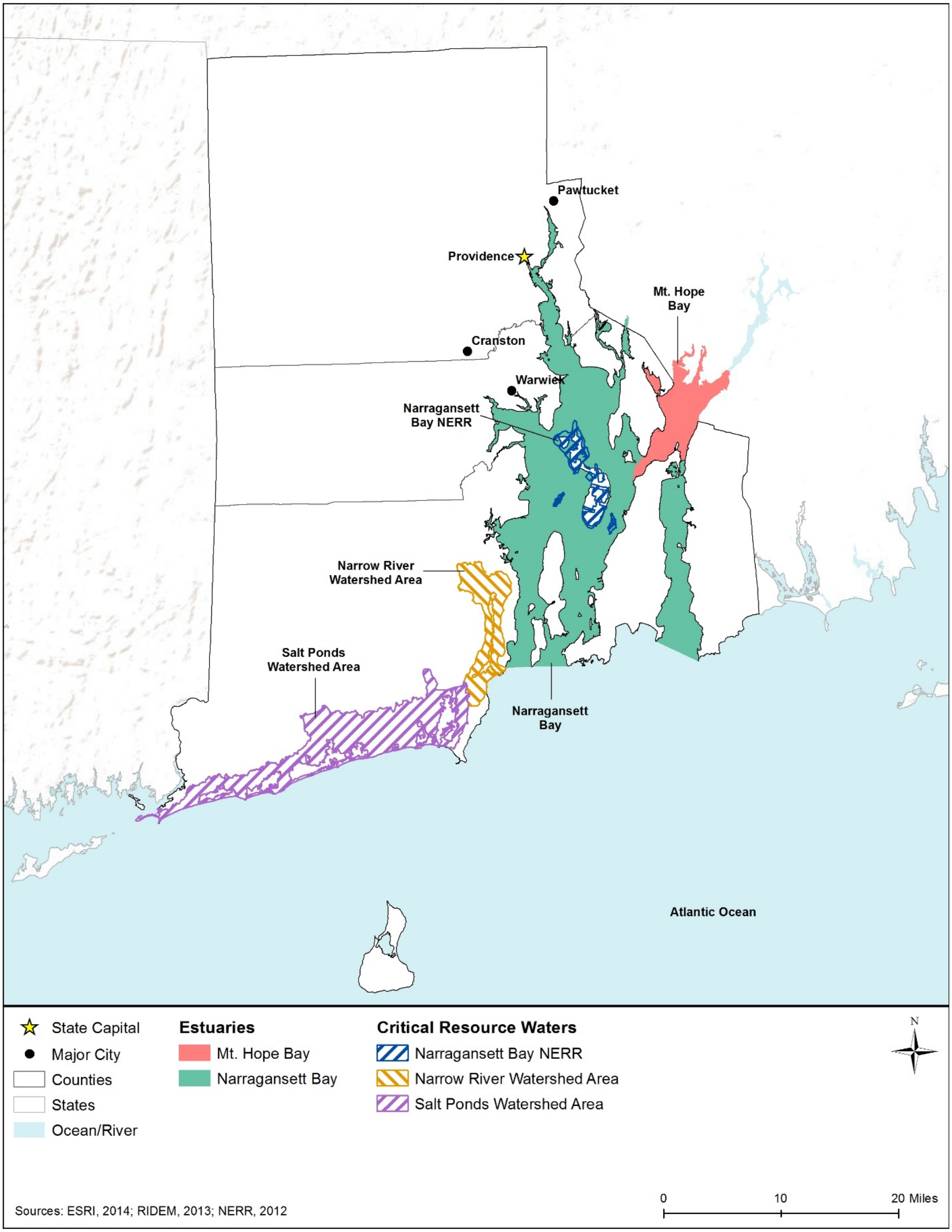

Figure 13.1.4-2: Rhode Island's Estuaries and Critical Resource Water

13.1.4.4. Sensitive or Protected Waterbodies

State Designated Critical Resource Waters

Rhode Island has designated the Salt Ponds region and the Narrow River region as critical resource waters[45] (RIDEM, 2010) (Figure 13.1.4-2). The Salt Ponds region is in southern Rhode Island and extends from the Westerly, a southwestern shoreline town in Rhode Island, to Narragansett Bay. The region forms a natural boundary between the freshwater aquifer of the South Coastal Basin and the Atlantic Ocean. Waters within the Salt Ponds region support a variety of commercial and recreational human uses, and serve as an important habitat for fish and waterfowl (RICRMC, 1999). The Narrow River, also known as Pettaquamscutt River, is a narrow tidal inlet located in southern Rhode Island that opens into the Atlantic Ocean at Narragansett Bay. The Narrow River watershed is a recreational resource and offers an ideal habitat for wildlife.

The other designated Rhode Island critical resource water is the Narragansett Bay Estuary (Figure 13.1.4-3) that is part of the National Estuarine Research Reserve (NERR) System. The Narragansett Bay NERR was designated in 1980, and is administered by NOAA and managed by RIDEM with assistance from local partners including the Town of Portsmouth, RI (as the local jurisdiction), the Audubon Society of Rhode Island, and the Prudence Conservancy[46] (RIDEM, 2015f).

Figure 13.1.4-3: Narragansett Bay Estuary

Source: (NOAA, 2015a)

The reserve protects approximately 4,259 acres and is located on several islands within the center of Narragansett Bay. The objective of the Narragansett Bay NERR is to "preserve, protect, and restore coastal and estuarine ecosystems of Narragansett Bay through long-term research, education and training" (NBNERR, 2015).

[45] Critical Resource Waters: include NOAA-designated marine sanctuaries, National Estuarine Research Reserves, National Wild and Scenic Rivers, critical habitat for federally listed threatened and endangered species, coral reefs, state natural heritage sites, and outstanding national resource waters or other waters officially designated by a state as having particular environmental or ecological significance and identified by the District Engineer after notice and opportunity for public comment. (ILDNR 2015)
[46] The Prudence Conservancy is a local land trust in Rhode Island. (RIDEM, 2015f)

13.1.4.5. 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,[47] the causes of impairment, and probable sources. Table 13.1.4-2 summarizes the water quality of Rhode Island's assessed major waterbodies by category, percent impaired, designated use,[48] cause, and probable sources. Table 13.1.4-2 and Figure 13.1.4-4 show the Section 303(d) waters in Rhode Island as of 2012.

As shown in Table 13.1.4-2, a variety of sources affect Rhode Island's waterbodies. According to the USEPA, 60 percent of Rhode Island's assessed rivers and streams are critically impaired. Designated uses of the impaired rivers and streams include fish and wildlife habitat, fish consumption, primary and secondary contact recreation, and shellfish controlled relay and depuration. Fifty-five percent of the lakes, reservoirs, and ponds are critically impaired, with designated uses including fish and wildlife habitat, fish consumption, primary and secondary contact recreation, and public drinking water supply; and 35 percent of the state's estuaries and bays are critically impaired. Designated uses of the impaired estuaries and bays include fish and wildlife habitat, primary and secondary contact recreation, shellfish consumption, and shellfish controlled relay and depuration. None of Rhode Island's coastal shoreline waters are impaired (USEPA, 2015b). More information on Rhode Island impaired waters is available from the USEPA at http://ofmpub.epa.gov/waters10/attains_state.control?p_state=RI .

Table 13.1.4-2: Section 303(d) Impaired Waters of Rhode Island, 2012

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	65%	60%	fish and wildlife habitat, fish consumption, primary contact recreation, secondary contact recreation, and shellfish controlled relay and depuration	pathogens[c], nuisance exotic species, metals, mercury, nutrients such as phosphorus	Urban runoff/storm sewers, wildlife, onsite treatment systems, wastes from pets, agriculture, and introduction of non-native organisms

[47] 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)

[48] 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)

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
Lakes, Reservoirs, and Ponds	74%	55%	fish and wildlife habitat, fish consumption, primary contact recreation, public drinking water supply, and secondary contact recreation	nuisance exotic species, mercury, nutrients such as phosphorus, dissolved oxygen, algal growth, flow alterations, metals, and pathogens	Introduction of non-native organisms, atmospheric deposition[d], urban runoff/storm sewers, internal nutrient recycling, and waterfowl
Estuaries and Bays	100%	35%	fish and wildlife habitat, primary and secondary contact recreation, shellfish consumption, and shellfish controlled relay and depuration	dissolved oxygen, pathogens, nutrients including nitrogen, temperature, toxics, and nuisance exotic species	combined sewer overflows, urban runoff/storm sewers, industrial cooling water intake and discharge, onsite treatment systems, waterfowl and wildlife
Coastal shoreline	100%	0%	NA	NA	NA

Source: (USEPA, 2012b)

[a] Some waters may be considered for more than one water type

[b] Rhode Island did not assess all waterbodies within the state.

[c] A pathogen is a bacterium, virus, or other microorganism that can cause disease (the presence of *Escherichia coli* and other fecal coliform bacteria can indicate the potential presence of pathogens).

[d] Atmospheric deposition occurs when pollutants are transferred from the air to the earth's surface. Pollutants can get from the air into the water through rain and snow, falling particles, and absorption of the gas form of the pollutants into the water.

NA= Not applicable

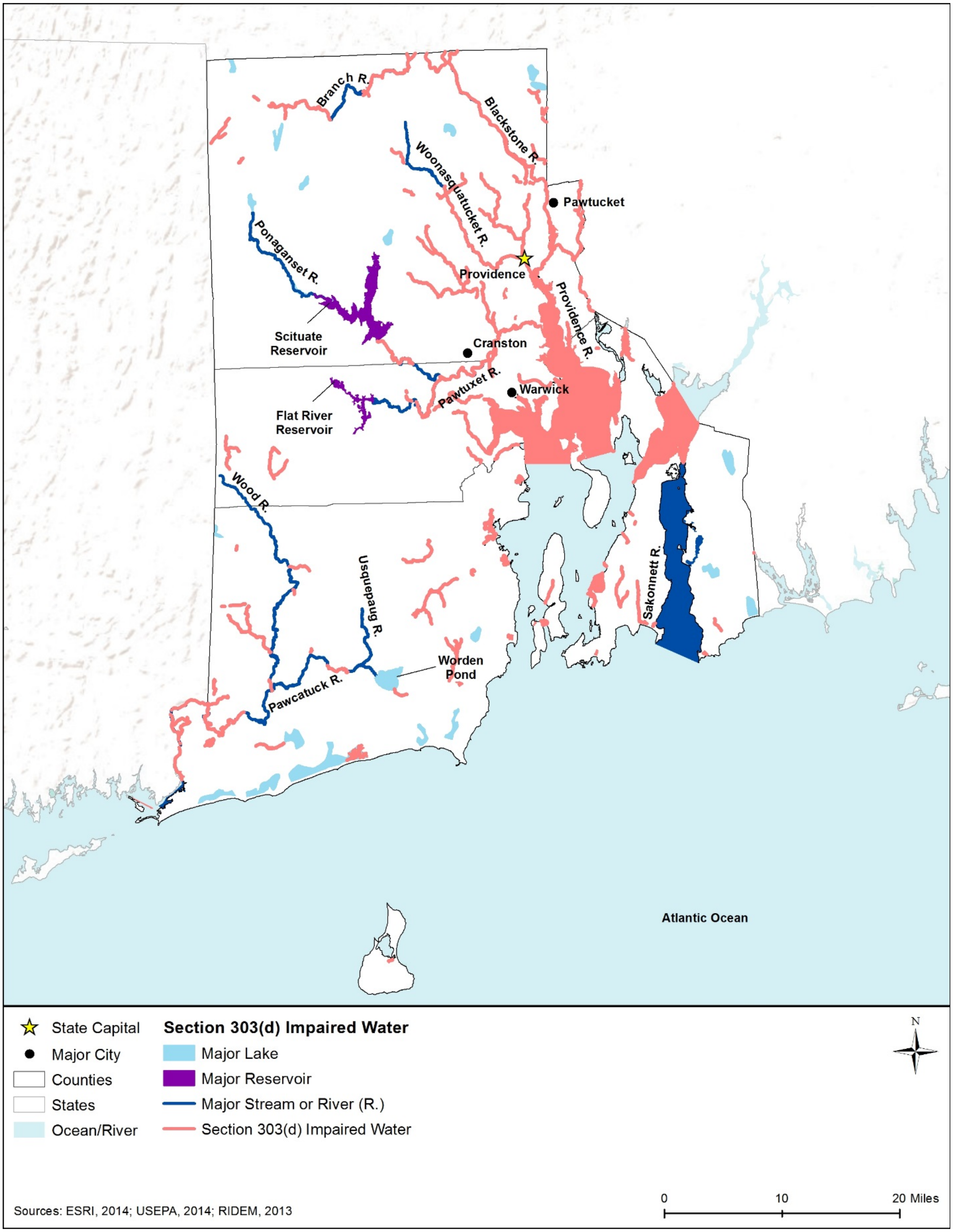

Figure 13.1.4-4: Section 303(d) Impaired Waters for Rhode Island

13.1.4.6. Floodplains

Floodplains are lowlands along inland or coastal waters, including flood-prone areas of offshore islands. 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). 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 provide shading, 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)

Floodplains in Rhode Island include the following:

- **Riverine floodplains:** Occur along rivers and streams where overbank flooding may occur, inundating adjacent land areas. In steep river valleys and hilly areas, 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 coastal floodplains, flooding resulting from storm surge is the primary concern. Storm surge can occur from both winter storms and tropical storms. Additionally, heavy rain events and overflowing upland waterbodies can also cause flooding in coastal floodplains (Johnson, 2010).

Flooding is the leading cause for disaster declaration by the President in the U.S. and is the most frequently occurring natural hazard in the state (NOAA, 2015b). The main causes of flooding in Rhode Island include coastal storms, severe thunderstorms, tropical storms, hurricanes, and intense rainfall on existing snowpack (RICRMC, 2009).

Since 1955, Rhode Island has had three major disaster declarations that resulted in severe flooding; one of which have occurred since 2010 (FEMA, 2015a). In March 2010, the President declared a state of emergency for Rhode Island due to severe storms and flooding resulting from significant rainfall over a period of several days cause by three consecutive slow-moving storms. Approximately 4 to 6 inches of rain fell on Rhode Island from the first storm event, which lead to significant flooding in many areas, including along the Pawtuxet River located by the city of Cranston. The second storm brought between 3 to 5 inches of rain across Rhode Island, and as much as 10 inches of rain fell on Rhode Island as a result of the third storm. Record flooding occurred along many streams and rivers, including the Pawtuxet River, which crested at 20.8 feet, resulting in severe flood impacts to the surrounding areas (Figure 13.1.4-5). (NOAA, 2013a)

Figure 13.1.4-5: Inundation from record flooding on the Pawtuxet River on Providence Street in West Warwick, RI

Source: (NOAA, 2013a)

Based on historical information of reoccurring flood events, Rhode Island has a high probability of future flood events due to its geographic location along the coast, as well as its abundance of waterways throughout the state. Future predictions of intense storm events due to climate change are also anticipated to cause significant flooding in Rhode Island. For example, the cities of Providence, Cranston, and Pawtucket are vulnerable to flooding due to the combination of storm surge and riverine flooding along major waterways, such as Narragansett Bay, Pawtuxet River, and Blackstone River, respectively. (RICRMC, 2009)

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. As of April 30, 2013, Rhode Island had 40 communities participating in the National Flood Insurance Program (NFIP). The NFIP was established to reduce the economic and social cost of flood damage. The program 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, 2015b). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities for doing more than the minimum NFIP requirements for floodplain management by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of July 2015, Rhode Island had eight communities participating in the CRS (Rhode Island Emergency Management Agency, 2015).[49]

13.1.4.7. Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and includes groundwater 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, 1999b). 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.

Rhode Island's principal aquifers consist of glacial deposits of stratified drift[50] and fractured bedrock. Approximately 26 percent of the state's population, or two-thirds of municipalities in Rhode Island, depend on groundwater for drinking water supply. Generally, the water quality of Rhode Island's aquifers is suitable for drinking and most uses. Over 90 percent of the state's groundwater can be used for drinking water without requiring treatment. The most serious threats to groundwater quality come from the vulnerability to contamination due to generally shallow depth to groundwater, as well as a general lack of confining layers[51] in the aquifer and greater permeability than those layers. (RIDEM, 2015g)

Table 13.1.4-3 provides details on aquifer characteristics in the state; Figure 13.1.4-6 shows Rhode Island's principal and sole source aquifers.

Table 13.1.4-3: Description of Rhode Island's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Aquifers of Alluvial and Glacial Origin These stratified-drift aquifers consist of the sand, gravel, and bedrock eroded by the glaciers	Throughout the state	Suitable for human consumption and other uses. Water is typically soft, slightly acidic, and cold, with concentrations of dissolved solids typically smaller than 200 mg/L. Groundwater in Rhode Island is quite vulnerable to contamination because of the unconfined conditions of the aquifers and the high water table (typically less than 20 feet beneath ground surface).

Sources: (Johnston & Barlow, 1987) (USGS, 1995)

Sole Source Aquifers

The USEPA defines sole source aquifers (SSAs) as "an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and are areas with no other

[49] A list of the CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014. (www.fema.gov/media-library-data/1398878892102-a5cbcaa727a635327277d834491210fec/CRS_Communites_May_ 1_2014.pdf) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system)

[50] Stratified drift aquifers are comprised of layers of gravel and sand that were deposited by melting glaciers as the glaciers retreated. (Ayotte, Nielsen, Gilpin R. Robinson, & Moore, 1999)

[51] A confining layer in an aquifer prevents water from passing through (or only allows for extremely slow movement). It is made up of material that has either minimal or no hydraulic conductivity or permeability. (NYSDEC, 2015a)

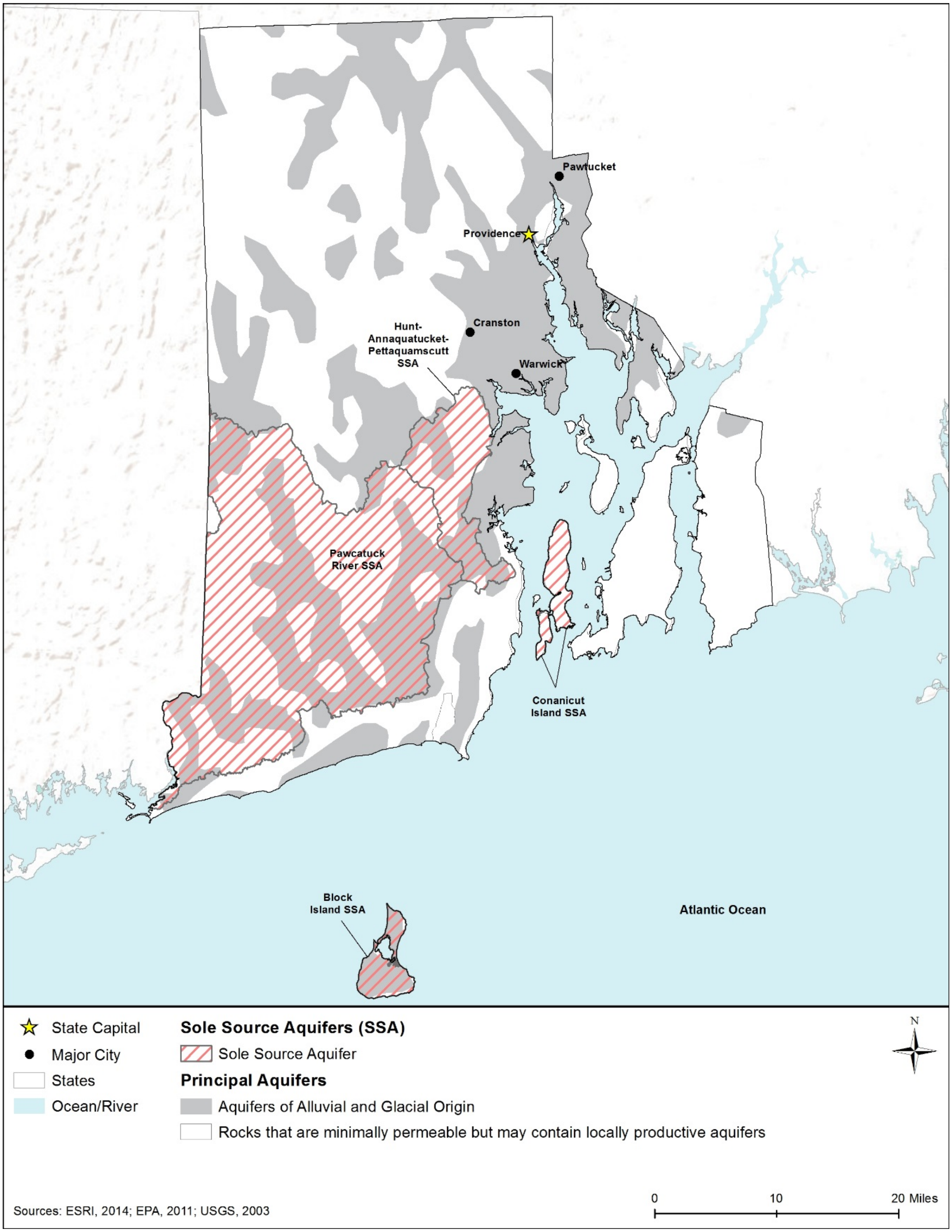

Figure 13.1.4-6: Principal and Sole Source Aquifers of Rhode Island

drinking water sources (USEPA, 2015c). Rhode Island has four designated SSAs within the state, including one that crosses into Connecticut (as shown in Figure 13.1.4-6). Designating a groundwater resource as an SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized (USEPA, 2015c).

13.1.5. Wetlands

13.1.5.1. 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 U.S. Environmental Protection Agency (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.

13.1.5.2. Specific Regulatory Considerations

Appendix C explains the pertinent federal laws to protecting wetlands in detail. Table 13.1.5-1 summarizes the major Rhode Island state laws and permitting requirements relevant to the state's wetlands.

Table 13.1.5-1: Relevant Rhode Island Wetlands Laws and Regulations

State Law/Regulation	Regulatory Authority	Applicability
CWA Section 404 permit	US Army Corps of Engineers (USACE), New England District	Applicants are required to obtain the appropriate state permits and USACE approval if they do not meet Category 1 guidelines. Criteria include projects located on the Narragansett Land Claim Settlement Area or sites that may influence this area and projects greater than 5,000 square feet
Freshwater Wetlands Act	Rhode Island Coastal Resources Management Council (CRMC)	Required for work within 200 feet of a wetland that falls under the jurisdiction of the CRMC
	RIDEM	Regulated activities in ponds at least 0.25 acres in size and hold water for more than six months, swamps at least three acres in size, marshes at least one acre in size, and bogs of any size are regulated. In addition, a perimeter of 50 feet surrounding these wetlands requires a permit, along with activities 100-foot and 200-foot riverbank wetlands (depending on size of the river). Wetlands that are smaller than these areas are referred to as "special aquatic sites" (e.g., vernal pools) and are still regulated, but there's no additional perimeter area

State Law/Regulation	Regulatory Authority	Applicability
Protection of Waters Program	RIDEM	Activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from RIDEM indicating that the proposed activity will not violate water quality standards

Sources: (U.S. Army Corps of Engineers, 2012) (RIDEM, 2008b)

13.1.5.3. Wetland Types and Functions

The U.S. Fish and Wildlife Service's (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. (1979) (Cowardin, Carter, Golet, & LaRoe, 1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats (Table 13.1.5-2). (USFWS, 2015a)

- The Marine System consists of open ocean, continental shelf, including beaches, rocky shores, lagoons, and shallow coral reefs. Normal marine salinity (saltiness) to hypersaline (more than 35 percent salty) water chemistry; minimal influence from rivers or 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 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 of 0.5 ppt or greater.
- 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 at least 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc.
- Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergent plants, or emergent mosses or lichens, and all wetlands that occur in tidal areas where the salinity is below 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 Rhode Island, the two main types of wetlands are palustrine (freshwater) wetlands found along river and lake floodplains across the state, and estuarine/marine (tidal) wetlands along the Atlantic Coast and Narragansett Bay. Table 13.1.5-2 uses 2014 NWI data to characterize and map Rhode Island wetlands on a on a broad-scale. The data are not intended for site-specific analyses and are not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations. Figure 13.1.5-1 depicts the wetlands found across the state. The map codes and colorings in Table 13.1.5-2 correspond to the wetland types in the figures.

Table 13.1.5-2: Rhode Island 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 silver maple-ash swamps are examples of PFO wetlands.	Throughout the state	55,461
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	Palustrine emergent 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,[52] prairie potholes, and sloughs.	Throughout the state	3,026
Palustrine unconsolidated bottom	PUB	PUB and PAB are commonly known as freshwater ponds, and includes all wetlands with at least 25% cover of particles smaller than stones and a vegetative cover less than 30%.	Throughout the state	4,825
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Lacustrine wetland	L2	Lacustrine systems are lakes or shallow reservoir basins generally consisting of ponded waters in depressions or dammed river channels, with sparse or lacking persistent emergent vegetation, including any areas with abundant submerged or floating-leaved aquatic vegetation. These wetlands are generally less than 8.2 feet deep.	Throughout the state	7
Estuarine intertidal 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 Atlantic Coast and Narragansett Bay	6,908

Sources: (Cowardin, Carter, Golet, & LaRoe, 1979) (USFWS, 2015a) (FGDC, 2013)

[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 have 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, 2015b)

Threats to wetlands in Rhode Island include the spread of invasive species, impacts from climate change, water management, and pollution. Both estuarine and palustrine wetlands are vulnerable

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

to invasive species. Invasive species have been identified in approximately half of surveyed freshwater wetland habitats in the state, and were observed in 90 percent of open emergent marshes[53], and included common reed (*Phragmites australis*), European bittersweet (*Solanum dulcamara*), and purple loosestrife (*Lythrum salicaria*). (RIDEM, 2015h)

Climate change (Section 13.1.4) is also a threat to both estuarine and palustrine wetlands in the state. Estuarine wetlands are most vulnerable, due to increased storm frequency and intensity combined with sea level rise. However, freshwater wetlands are also vulnerable to hydrologic changes, including freshwater marshes near the coast that are flooded with salt water. (RIDEM, 2015h)

Impacts to wetlands from water management can occur directly or indirectly as a result of actions that modify water flow patterns. These can result from activities such as surface and groundwater withdrawal, surface water diversion, and dam construction. (RIDEM, 2015h)

Palustrine Wetlands

In Rhode Island, palustrine wetlands include palustrine forested, scrub-shrub, emergent, and open water wetlands. The palustrine forested wetland (wooded swamp) is the most common wetland type in the state. Red maple (A*cer rubrum*) or Atlantic white cedar (*Chaemaecyparis thyoides*) trees typically dominate these wetlands. The red maple-dominated swamps occur in poorly and very poorly drained soils throughout the state, and are the more common of the two (RIDEM, 1999). Other types of palustrine wetlands found in Rhode Island include bogs[54], emergent shrub wetlands, marshes, swamps, and vernal ponds (University of Rhode Island, 2015).

In 1971, Rhode Island Legislature passed the Freshwater Wetlands Act to “preserve the purity and integrity of the State's freshwater wetlands in order to protect the health, welfare, and general well-being of the public” (RIDEM, 1999). This Act requires approval by RIDEM for any activity that may alter the character of any freshwater wetland (as defined in the Act), no matter the size of the wetland (University of Rhode Island, 2015).

After six years of analysis through Rhode Island Wetland Monitoring and Assessment program, the most common sources of pollution to wetlands in the state were identified. 500-foot buffers of 245 wetlands were assessed, with raised roadbeds and unsewered[55] residential development the most common stressors. Additionally, pollution caused from human activity (nutrients, sediments, toxins, and salts) and filling and dumping were the most common in-wetland stressors for 164 wetlands assessed. (RIDEM, 2015h)

[53] Open emergent marshes are wetlands permanently or frequently flooded with water around shorelines out to shallow water and covered with emergent plant species with less than 25 percent shrub or tree cover (The Wetlands Initiative, 2015) (Vermont Fish & Wildlife, 2015)

[54] Bog: A wet, spongy, poorly drained area that is usually rich in very specialized plants, contains a high percentage of organic remnants and residues, and frequently is associated with a spring, seepage area, or other subsurface water source. (USACE 2015)

[55] Unsewered: stormwater is not channeled into a sewer system, but instead flows over the ground surface into waterways or is absorbed into the ground. (FHWA, 2011)

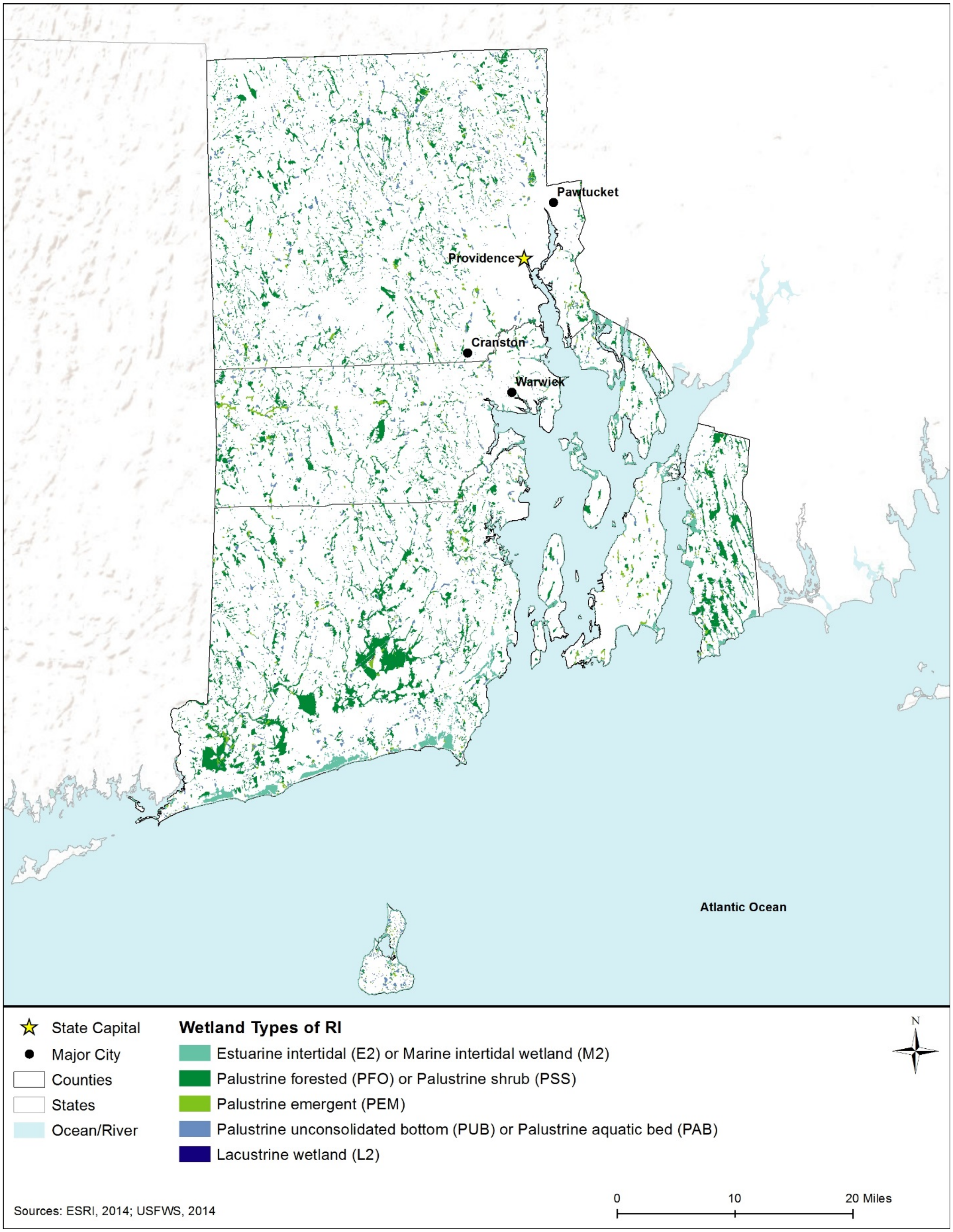

Figure 13.1.5-1: Wetlands by Type, in Rhode Island, 2014

Estuarine and Marine Wetlands

In Rhode Island, coastal wetlands include salt marshes, as well as freshwater or brackish wetlands that are contiguous to salt marshes or physiographic features. Freshwater or brackish wetlands that are associated directly with non-tidal coastal ponds, and those that occur on a barrier beach or are separated from tidal waters by a barrier beach are also considered coastal wetlands. Additionally, open water areas within coastal wetlands are also considered wetlands. (CRMC, 2013)

Lacustrine Wetlands

Lacustrine wetlands are not common in the state, and thus are not discussed.

13.1.5.4. Wetlands of Special Concern or Value

Vernal Pools

In Rhode Island, vernal pools of all sizes are protected under the Freshwater Wetlands Act, and are referred to as "special aquatic sites." Vernal pools will fill up with water in the spring and fall, with some found in wetlands such as red maple swamps, and others are isolated woodland depressions, and by mid-summer they typically dry up as they lack a permanent water source. Vernal pools provide important habitat for wildlife, including spotted salamanders (*Ambystoma maculatum*), marbled salamanders (*Ambystoma opacum*), and wood frogs (*Lithobates sylvaticus*). (RIDEM, 2015i)

National Estuarine Research Reserve

The Narragansett Bay National Estuarine Research Reserve (NERR) includes approximately 4,300 acres of upland, aquatic, and estuarine habitat in the Narragansett Bay. The three islands of Prudence, Patience, and Hope are in the geographic center of the Bay, approximately 12 miles south of Providence, and are comprised of habitats such as coastal grassland, shrubland, and marshes, rocky and cobble[56] shores, maritime forests, lowland streams, and muddy bottoms. (NOAA, 2015a)

Figure 13.1.5-2: Salt marsh hay at Narragansett Bay NERR

Source: (NOAA, 2015c)

The Narragansett Bay NERR contains both freshwater and coastal wetlands. The shoreline has many narrow cobble beaches, but fringe and meadow salt marshes are found in low energy, depositional areas.

[56] A cobble is a rounded sedimentary rock between 64 and 256 millimeters. (Geology.com, 2015)

Coastal wetland restoration efforts in the Bay are ongoing, and include protection of eelgrass (*Zostera* spp.) beds and saltmarsh habitat. The Bay also provides habitat important to many estuarine and marine birds and animals throughout the year. (NOAA, 2015c)

Other important wetland sites in Rhode Island include:

- Wildlife Management Areas are designated for outdoor recreation; these public lands encompass more than 45,000 acres. (RIDEM, 2015j) To learn more about state Wildlife Management Areas, visit www.dem.ri.gov/programs/bnatres/fishwild/index.htm .
- One National Natural Landmarks (Ell Pond) is owned by Rhode Island Audubon Society and The Nature Conservancy (NPS, 2015b). Visit www.nature.nps.gov/nnl/state.cfm?State=RI to learn more about this National Natural Landmark.
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups found across the state, including NRCS Agricultural Conservation Easement Program, Farm Service Agency Conservation Reserve Program, and easements managed by natural resource conservation groups such as state land trusts, The Nature Conservancy, Rhode Island Audubon Society, and Weekapaug Foundation for Conservation. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), NRCS holds more than 200 acres in conservation easements in Rhode Island (NCED, 2015).

For more information on Rhode Island's wildlife management areas, National Natural Landmarks, conservation programs, and easements, see Section 13.1.8, Visual Resources, and Section 13.1.7, Land Use, Recreation, and Airspace.

13.1.6. Biological Resources

13.1.6.1. Definition of the Resource

This Chapter describes the biological resources of Rhode Island. Biological resources include terrestrial[57] vegetation, wildlife, fisheries and aquatic habitats[58], and threatened[59] and endangered[60] species, and communities and species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Because of Rhode Island's location along the Atlantic coast, the state supports a wide diversity of biological resources ranging from barrier beaches and Block Island at the coast, to the extensive wetland systems of the pristine Wood-Pawcatuck river watershed, to the rolling forests of western Rhode Island, which is largely rural in nature. Each of these topics is discussed in more detail below.

[57] Terrestrial: "Pertaining to the land." (USEPA, 2015d)
[58] Habitat: "The place where a population lives, including its living and non-living surroundings." (USEPA, 2015d)
[59] Threatened: "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))
[60] Endangered: "Any species which is in danger of extinction throughout all or a significant portion of its range." (16 U.S.C §1532(6))

13.1.6.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations, including those requirements that specifically apply to biological resources. The pertinent federal laws relevant to the protection and management of biological resources in Rhode Island are summarized in Appendix C. Table 13.1.6-1 summarizes the Rhode Island's laws relevant to the state's biological resources.

Table 13.1.6-1: Relevant Rhode Island Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
State of Rhode Island General Laws Title 2, Agriculture and Forestry	RIDEM	Provides a list of all prohibited and regulated invasive[a] plant species for Rhode Island.
State of Rhode Island General Laws Title 20, Rhode Island State Endangered Species Act (ESA)	RIDEM Department of Fish and Wildlife (DFW)	Protection of threatened and endangered species in Rhode Island.

[a] Invasive: "These are species that are imported from their original ecosystem. They can out-compete native species as the invaders often do not have predators or other factors to keep them in check." (USEPA, 2015e)

13.1.6.3. Terrestrial Vegetation

The distribution of flora within the state is a function of the characteristic geology[61], soils, climate, and water of a given geographic area and correlate to distinct areas identified as ecoregions[62]. These ecoregions are broadly defined areas that share similar characteristics, such as climate, 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, 2015) (World Wildlife Fund, 2015).

Ecoregion boundaries often coincide with physiographic[63] regions of a state. The ecoregions mapped by the USEPA are the most commonly referenced, although individual states and organizations have also defined ecoregions that may differ slightly from those designated by the USEPA. The USEPA Level I ecoregion is the coarsest level, dividing the U.S. into 15 ecological regions. Level II further divides the country into 50 regions. The continental U.S. contains 104 Level III ecoregions and the contiguous states have 84 ecoregions. This section presents a discussion of biological resources for Rhode Island at USEPA Level III (USEPA, 2015f).

As shown in Figure 13.1.6-1 and according to the USEPA, Rhode Island is almost entirely within the Level III Northeastern Coastal Zone ecoregion with Block Island a Level III Atlantic Coastal

[61] 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 ground-water availability.
[62] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables." (USEPA, 2015d)
[63] Physiographic: "The natural, physical form of the landscape." (USEPA, 2015d)

Pine Barrens. This region supports a variety of different plant communities; all predicated on their general location within the state. Communities range from coastal plains and hills covering the majority of the inland areas within state that support oak-hickory forests and hardwood communities. The eastern lowlands have limited oak-pine forests with a coastal influence and predominately consist of wetlands and bogs. Within the southern region of the state along the Long Island Sound, dense thickets of vines and shrubs dominate with sandy dunes and associated vegetation to a lesser degree. Table 13.1.6-2 provides a summary of the general abiotic[64] characteristics, vegetative communities, and the typical vegetation found within Rhode Island.

Communities of Concern

The Rhode Island Natural Heritage Program (RINHP) statewide inventory includes individual plant and wildlife species that have been deemed species of concern, state listed, or federally listed. Many state heritage programs also use State Ranks (S1, S2, S3, S4) to designate vegetative communities of concern. This ranking 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. However, the RINHP does not maintain these rankings for vegetation communities within the state (Jordan, 2015).

The Rhode Island Wildlife Action Plan provides an overview of key habitats within the state (RIDEM, 2015k). There are 84 key habitats within the state; of these, 34 have a high degree of threat, and 27 are vulnerable to climate change. Each of these key habitats include distinct natural community types. There are nine natural community types described as rare within the state (Enser & Lundgren, 2006). Rhode Island Appendix B, Table B-1, describes these communities.

[64] Abiotic: "Nonliving characteristic of the environment; the physical and chemical components that relate to the state of ecological resources." (USEPA, 2015d)

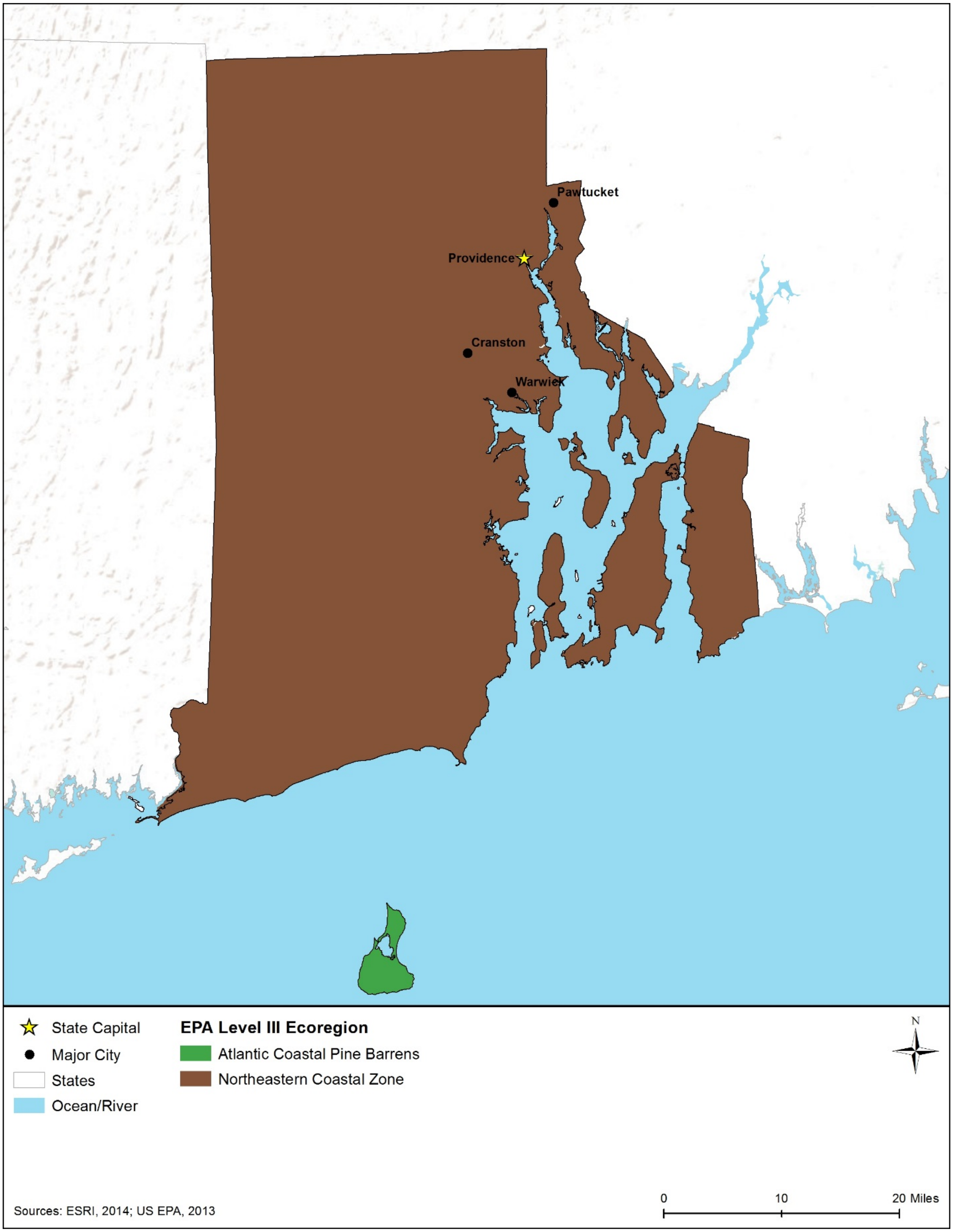

Figure 13.1.6-1: USEPA Level III Ecoregions of Rhode Island

Table 13.1.6-2: USEPA Level III Ecoregions of Rhode Island

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
59	Northeastern Coastal Zone	Composed of irregular plains and plains with high hills, on nutrient poor soils with numerous glacial lakes.	Appalachian Oak Forest and Northeastern Oak-Pine Forest	• **Hardwood Trees** – oaks (*Quercus* spp.), sweetgum (*Liquidambar* spp.), persimmon (*Diospyros* spp.), red maple (*Acer rubrum*), American holly (*Ilex opaca*), black birch (*Betula lenta*), American chestnut (*Castanea dentata*), hickories (*Carya* spp.) • **Conifer Trees** – white pine (*Pinus strobus*), pitch pine (*Pinus rigida*) • **Shrubs** – eastern dogwood (*Cornus florida*)
84	Atlantic Coastal Pine Barrens	Nutrient poor, often acidic soils, with dominate pine tree species.	Temperate Coniferous Forest	• **Hardwood Trees –** Oaks (*Quercus* spp.) • **Conifer Trees** – Pitch pine *(Pinus rigida)*, shortleaf pine *(Pinus echinata)* • **Shrubs** – Black huckleberry *(Gaylussacia baccata)*, mountain laurel *(Kalmia latifolia)*, staggerbrush *(Lyonia mariana)*

Source: (USEPA, 2015f)

Nuisance and Invasive Plants

Nuisance and invasive plants are a broad category that includes a large number of undesirable plant species. Direct impacts to nuisance and invasive plants may be viewed as beneficial to the environment, but often such impacts result in the inadvertent and unintended spread and dispersal of these species. Construction sites in particular provide colonizing opportunities for nuisance and invasive species, and long-term maintenance activities can perpetuate a disturbance regime that facilitates a continued dispersal mechanism for the spread of these species.

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

The Rhode Island Natural History Survey maintains a list of widespread and invasive species, as well as a list of restricted and invasive species. Widespread and invasive species must be widespread within the state with many populations in minimally managed natural habitats, while restricted and invasive species must be common within a part of the state or a particular habitat type(s) in the state with many populations in minimally managed natural habitats. The most recent list (October 2013) includes a total of 69 plant species, 24 are classified as widespread and invasive (see below), 45 are classified as restricted and invasive terrestrial species (Rhode Island Invasive Species Council, 2013).

- **Aquatic –** fanwort (*Cabomba caroliniana*), variable milfoil (*Myriophyllum heterophyllum*), and curly leaved pond-weed (*Potamogeton crispus*).
- **Trees, Shrubs, and Vines –** tree of heaven (*Ailanthus altissima*), black locust (*Robinia pseudoacacia*), Japanese barberry (*Berberis thunbergii*), autumn olive (*Elaeagnus umbellata*), winged euonymus (*Euonymus alatus*), glossy buckthorn (*Frangula alnus*), common privet (*Ligustrum vulgare*), Morrow's honeysuckle (*Lonicera morrowii*), common buckthorn (*Rhamnus cathartica*), multiflora rose (*Rosa multiflora*), gray willow (*Salix cinerea*), Oriental bittersweet (*Celastrus orbiculatus*), black swallowwort (*Cynanchum louiseae*), and Japanese honeysuckle (*Lonicera japonica*).
- **Terrestrial Forbs, Grasses, and Grass-like Plants –** cheatgrass (*Bromus tectorum*), black knapweed (*Centaurea jacea*), Japanese knotweed (*Fallopia japonica*), purple loosestrife (*Lythrum salicaria*), tufted knotweed (*Persicaria longiseta*), reed canary grass (*Phalaris arundinacea*), and tall reed (*Phragmites australis*).

13.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Rhode Island, divided among mammals, birds, reptiles and amphibians, and invertebrates. Terrestrial wildlife consist of those species, and their habitats, that live predominantly on land, such as common big game species, small game animals and furbearers[65], nongame animals, and game birds and waterfowl and their habitats that may be found in Rhode Island. A discussion of non-native and/or invasive terrestrial wildlife species is also included. 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. According to RI DEM, there are 89 mammal species, 46 reptile and amphibian species, 426 resident and migratory birds species, and 849 invertebrates considered to comprise the fauna[66] within Rhode Island (RIDEM, 2015l).

Mammals

Common and widespread mammal species in Rhode Island include the gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*). The state has 89 mammals with most of these mammals either indigenous or native within the state. One endangered mammal is found in Rhode Island (USFWS, 2015c). Section 13.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies and describes these protected species.

Mammal species introduced to Rhode Island include the house mouse (*Mus musculus*) and Norway rat (*Rattus norvegicus*). Coyotes (*Canis latrans*) represent one of the more successful recent natural mammalian expansions, establishing populations throughout Rhode Island. Exotic[67] mammals currently do not pose a large conservation problem in the state. However, some native mammals, such as the striped skunk (*Mephitis mephitis*) and raccoon (*Procyon lotor*), have adapted well to urban and suburban environments and their populations have grown to nuisance levels.

White-tailed deer (*Odocoileus virginianus*) are the only deer species in Rhode Island and are classified as big game species. They can be found throughout the state, including many of the Bay Islands (RIDEM, 2015m). Small game species include small mammals (e.g., squirrels and rabbits) and upland and migratory game birds. Further, the following species of furbearers may be legally hunted in the state: coyote, beaver (*Castor canadensis*), fisher (*Martes pennanti*), raccoon, red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), opossum (*Didelphimorphia*), skunk (*Mephitidae*), weasel (*Mustela* spp.), American mink (*Neovison vison*), and muskrat (*Ondatra zibethicus*) (RIDEM, 2015n).

Rhode Island has identified 21 mammals as Species of Greatest Conservation Need (SGCN) (RIDEM, 2015u). The SGCN list consists of at-risk species that are rare or declining, and State Wildlife Grants can provide funding for efforts to reduce their potential to be listed as endangered. The SGCN list is updated periodically and is used by Rhode Island to focus their conservation efforts and as a basis for implementing their State Wildlife Action Plan (SWAP) (RIDEM, 2015k).

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65 Furbearer is the name given to mammals that traditionally have been hunted and trapped primarily for fur.
66 Animals within an area
67 Exotic: "A non-native plant or animal introduced from another geographic area." (USEPA, 2015d)

Birds

The number of native bird species documented in Rhode Island varies according to the timing of the data collection effort, changes in bird taxonomy[68], and the reporting organization's method for categorizing occurrence and determining native versus non-native status. This section begins with a summary of native bird species found in Rhode Islnd, and although the numbers differ slightly, the taxonomic richness of the state is evident. The variety of ecological communities (i.e., coastal areas, mountains, large rivers and lakes, plains, etc.) in Rhode Island in turn supports a large variety of bird species.

As of 2015, over 425 species of resident and migratory birds have been documented in Rhode Island (RIDEM, 2015l) (Conway, 1992) (August, Enser, & Gould, 2001) (Rhode Island Ornithological Club, 2014). Of those birds, approximately 93 are coastal species and 44 are freshwater aquatic species (e.g., lakes, wetlands, etc.). The remaining species occupy predominately terrestrial habitats throughout the state.

Rhode Island is located within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. It is the most densely human-populated of the four waterfowl migration flyways in North America (i.e., Atlantic, Mississippi, Central, and Pacific), and many waterfowl species are thus threatened by urban sprawl and development (Ducks Unlimited, 2015). Nevertheless, large numbers of waterfowl and non-waterfowl birds utilize this flyway and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall. Despite the dense human population and development, the coastal areas of Rhode Island are an important ecological resource for migrating birds (National Audubon Society Inc., 2015). The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations. 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. Bald eagles are generally found near large rivers and lakes in the entire state all year (eBird, 2015a). Golden eagles are generally found around mountains and cliffs where they nest. Golden eagles are found in the southern and eastern parts of the state, and are seen throughout the year (eBird, 2015b).

A number of Important Bird Areas (IBAs) have also been identified in Rhode Island (Figure 13.1.6-2). The IBA program is an international bird conservation initiative with a goal of identifying the most important places for birds, and to conserve these areas. These IBAs are identified according to standardized, scientific criteria through a collaborative effort among state, national, and international conservation-oriented non-governmental organizations (NGOs), state and federal government agencies, local conservation groups, academics, grassroots

[68] Taxonomy: "A formal representation of relationships between items in a hierarchical structure." (USEPA, 2015d)

environmentalists, and birders. These IBAs link global and continental bird conservation priorities to local sites that provide critical habitat[69] for native bird populations.

A total of 18 IBAs have been identified in Rhode Island, including breeding[70], migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as forests, scrub/shrub, grasslands, freshwater and saltwater wetlands, and bodies of water (National Audubon Society Inc. 2015). These IBAs, identified below, are mainly distributed throughout the state although there are clusters around the southern coast and eastern islets. Washington County for example, which is located along the southern coast of the state, includes 8 IBAs covering over 1.3 million acres.

Southern Rhode Island

- Gallilee Marshes
- Maschaug Pond and Beach
- Napatree Point/Sandy Point
- Ninigret Pond and Conservation Areas
- Pettaguamscutt Cove
- Weekapaug – Quonochontaug
- Trustom Pond/Moonstone Beach
- Arcadia Forest Block
- Marsh Meadows
- Sachuest Point and 3rd Beach
- Quicksand/Tunipers Pond – Goosewing Beach
- Sapowet Marsh Wildlife Management Area
- Weetamoo Woods
- Prudence and Patience Islands

Northern Rhode Island

- Hundred Acre Cove
- Potomowut River
- Arcadia Forest Block
- Hundred Acre Cove
- Palmer River
- Rumstick/Jacobs Points

[69] Critical habitat: “A designated area that is essential to the conservation of an endangered or threatened species that may require special management considerations or protection.” (USEPA, 2015d)
[70] Breeding areas: “The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared.” (USEPA, 2015d)

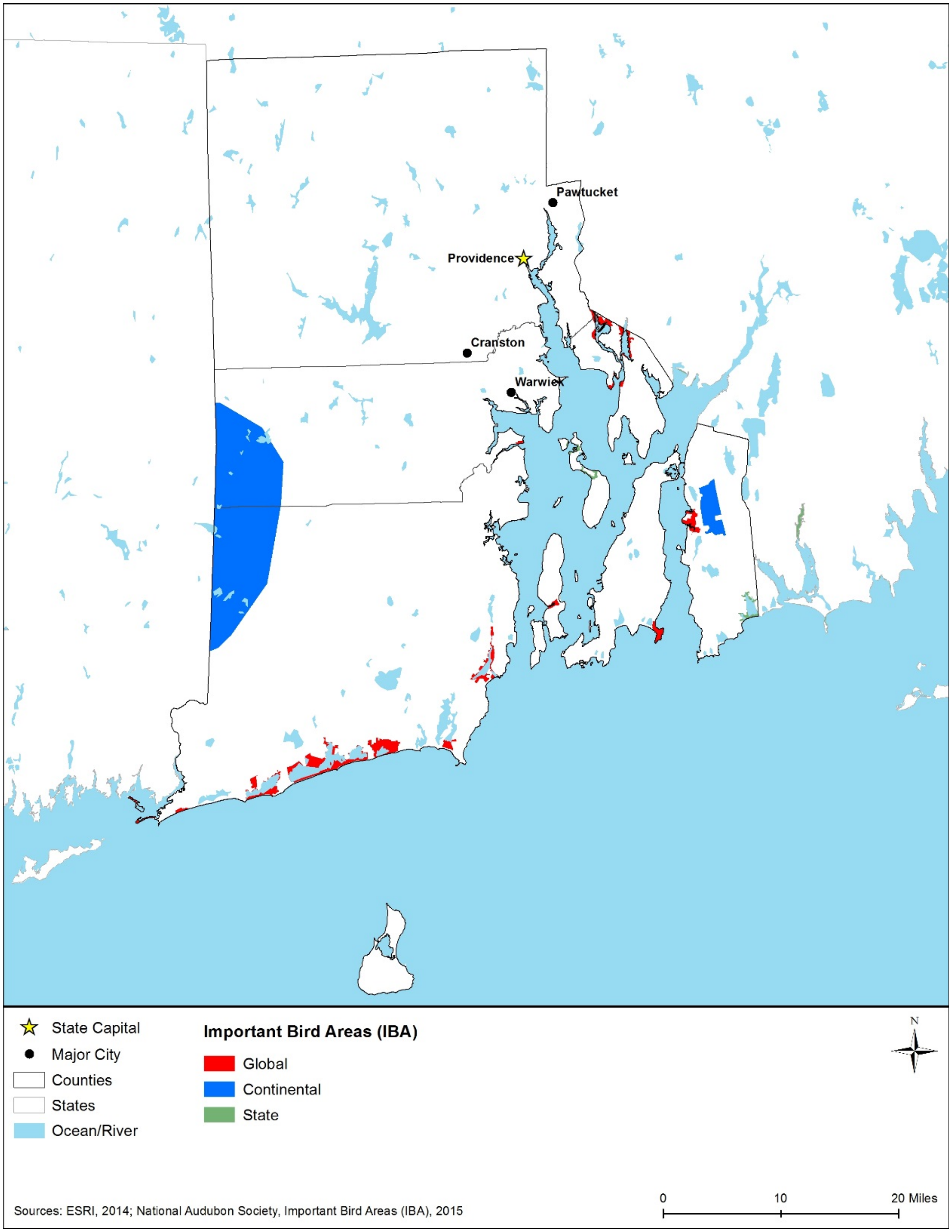

Figure 13.1.6-2: Important Bird Areas in Rhode Island

Two federally listed birds are located in Rhode Island. Section 13.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies and briefly describes these protected species.

Reptiles and Amphibians

A total of 46 native reptile and amphibian species occur in Rhode Island, including salamanders, frogs and toads, turtles, and snakes (RIDEM, 2015l). These species occur in a wide variety of habitats from the state's shoreline to upper woodlands, as well as in cities and suburbs. A large number of species that are widely distributed across the entire state, include the spring peeper (*Pseudacris crucifer*), green frog (*Rana clamitans*), common snapping turtle (*Chelydra serpentine*), painted turtle (*Chrysemys picta*), common garter snake (*Thamnophis sirtalis*), northern redbelley snake (*Storeria occipitomaculata occipitomaculata*), and eastern milk snake (*Lampropeltis triangulum*) (RIDEM, 2016a) (RIDEM, 2016b) (RIDEM, 2016c).

Rhode Island followed many eastern states and adopted legislation that gave all native reptiles and amphibians legal protection as game species. This law does not differentiate between wild-caught and captive-bred animals or animals possessed prior to the enactment of the law. The law applies to any life form, which includes eggs and larvae. The only turtle species with an open hunting season is the snapping turtle (RIDEM, 2013b).

There are currently three listed reptiles and amphibians located in Rhode Island. Section 13.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies and describes these protected species.

Invertebrates

Rhode Island is home to a large number of invertebrate species, including bees, hornets, wasps, butterflies, moths, beetles, flies, dragonflies, damselflies, spiders, mites, crustaceans, and nematodes. These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. In the U.S., one third of all agricultural output depends on pollinators. 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.

Over 400 terrestrial and marine invertebrate species within Rhode Island are currently tracked in the Rhode Island Natural Heritage Program Database, with 56 being listed at the state level of endangered, threatened, or species of concern (RIDEM, 2015k).

One federally endangered invertebrate is known to occur in Rhode Island. Section 13.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies and describes this protected species.

Invasive Wildlife Species

Rhode Island has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select plant and animal invasive species. Regulations associated with invasive species are within Rhode Island's General Law: Title 2, Agriculture and Forestry; Title 4, Animals and Animal Husbandry; Title 20, Fish and Wildlife;

Title 42, State Affairs and Government; and, Title 46, Waters and Navigation. 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 (Aquatic Nuisance Species Task Force, 2007).

13.1.6.5. Fisheries and Aquatic Habitats

This section discusses the aquatic wildlife species in Rhode Island, including fish, invertebrates, marine mammals, and sea turtles. A summary of non-native and/or invasive aquatic species is also presented. Fish are divided into freshwater and saltwater species, although many of Rhode Island's fish are diadromous[71] (i.e., anadromous[72] and catadromous[73]), reflecting the state's location along the Atlantic coast and the variety of aquatic habitats it provides. A distinctive feature of the Rhode Island landscape with regard to aquatic wildlife is the coastal/island habitats. This area includes open ocean, estuaries, bays, inlets, and other coastal features that provide habitat for a multitude of wildlife.

Freshwater Fish

Rhode Island is home to more than 72 species of freshwater fish, ranging in size from small darters and minnows to large species such as salmon and sturgeon (Libby, 2013). These species are grouped into 34 families, including, true bass, catfishes, herrings, common minnows, true perch, pikes, common prey fish, salmon, sturgeons, sunfish, and trout. Many of these fish families include diadromous species, such as the anadromous American shad (*Alosa sapidissima*), river herring (*Alosa pseudoharengus*), striped bass (*Morone saxatilis*), and Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), and the catadromous American eel (*Anguilla rostrate*). Approximately, 30 species spend time in both fresh water and saltwater.

Freshwater fish and associated freshwater habitats are considered one of the most highly threatened ecosystems based on the vast decline in species population numbers. Approximately 40 percent of fish species in North America are considered at risk or vulnerable to extinction[74] (National Fish Habitat Board, 2010). Major threats to freshwater fisheries include habitat modification and destruction (dams, culverts, weirs, urban development, and agricultural practices), overfishing, invasive species, environmental pollution, and impaired water quality. Among freshwater fish in Rhode Island and the northeastern United States in general, three groups of fish are considered to be the most threatened by habitat loss and degradation[75]: headwater fishes, lake fishes, and migratory fishes (National Fish Habitat Board, 2010).

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[71] Diadromous: "Fish that migrate between freshwater and saltwater for breeding or feeding." (USDA, 2016)

[72] Anadromous: "Referring to the lifecycle of fishes, such as salmon, in which adults travel upriver from the sea to breed, usually returning to the area where they were born." (USEPA, 2015d)

[73] Catadromous: "An organism which lives in fresh water and goes to the sea to spawn, such as some eels." (USEPA, 2015d)

[74] Extinction: "The disappearance of a species from part or all of its range." (USEPA, 2015d)

[75] Degradation: "The reduction of the capacity of the environment to meet social and ecological objectives, and needs. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards." (USEPA, 2015d)

Saltwater Fish

Rhode Island's near shore marine waters are home to a large number of fish species, inhabiting the wide variety of marine habitats such as the Narragansett Bay, Block Island Sound, and Rhode Island Sound. In addition, Rhode Island shares the waterway with the northern shore of Long Island, which is situated in such a way that both northern and southern fish species occupy the surrounding waters, and the fish community on either end of the island can vary widely at any given time.

Many saltwater fish species are well known by their recreational and commercial fishing value. The anadromous striped bass (*Morone saxatilis*) is a high-profile and important fish species for both recreational anglers and the commercial fishing industry and can be found in Narragansett Bay. The blue fin tuna (*Thunnus thynnus*) are also in abundance through July and August (Rhode Island Anglers Association, 2015).

Table 13.1.6-3: Popular Saltwater Sportfish Species in Rhode Island

Common Name	General Habitat
Blue Shark	Permanent freshwater streams (nonbreeding), open ocean (breeding)
Bluefin Tuna	Coastal
Bluefish	Hard sea bottoms with rocks, cobble, gravel, or sand
Bonito	Open ocean, with a preference for near shore areas
Cod	Open ocean, preference for near-surface in warmer months and deep water in winter
Hickory Shad	Large rivers (breeding), open ocean (nonbreeding)
King Mackerel	Bays and sounds with hard bottoms averaging 180 offshore
Mackerel	Rocky areas and around pilings, seawalls, wharves, and seaweed beds
Mako Shark	Open ocean
Pollock	Coastal
Scup	Inner continental shelf (breeding); estuaries and inshore (larvae)
Sea Bass	Shallow coastal waters
Squeteque	Bays, estuaries, and protected coastal waters
Striped bass	Coastal, within a few miles of shore except during migration; large rivers (breeding)
Summer Flounder	Coastal (nonbreeding), deeper ocean (breeding)
Swordfish	Open Ocean
Tautog	Coastal, in rocky areas and around pilings, breakwaters, and wrecks
White Marlin	Sandy bottom estuaries and near shore
Winter Flounder	Deeper waters (summer), shallow estuaries, rivers, and bays (winter)
Yellowfin Tuna	Along beaches, inlet mouths, and large estuaries; deeper ocean during winter

Source: (RIDEM, 2013c)

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (the Act) is the primary law governing marine fisheries management in U.S. federal waters. The Act calls for the identification and protection of fish habitats that are necessary for spawning, breeding, feeding, or growth to maturity. These habitats are termed "Essential Fish Habitat" or EFH. The National Marine Fisheries Service (NMFS) provides an online mapping application and a website to provide the public a means to obtain illustrative representations of EFH. The online mapping tool is available at http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html, and the EFH website is available at http://www.greateratlantic.fisheries.noaa.gov/hcd/list.htm/. When assessing site-specific projects locations, this tool can be used to identify the potential for any conflicts between project activities and sensitive resources. Table 13.1.6-4 presents a summary of EFH offshore of Rhode Island.

Table 13.1.6-4: Essential Fish Habitat Offshore of Rhode Island

Common Name	Eggs	Larvae/YOY[76]	Juveniles	Adults
Atlantic bluefin tuna	NA	NA	NA	Block Island
Atlantic cod	Block Island	Block Island	Block Island	Block Island Sound
Atlantic herring	NA	NA	Narragansett Bay	Narragansett Bay
Basking shark	NA	NA	Block Island	Block Island
Dusky shark	NA	NA	NA	NA
Clearnose skate	NA	NA	NA	NA
Haddock	NA	Narragansett Bay	NA	NA
Little skate	NA	NA	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound
Monkfish	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound	NA	NA
Ocean pout	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound
Pollock	NA	NA	NA	NA
Red hake	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound	Narragansett Bay
Sand tiger shark	NA	NA	NA	NA
Sandbar shark	NA	NA	Block Island	Block Island
Scalloped hammerhead shark	NA	NA	NA	NA
Shortfin mako shark	NA	NA	Block Island	Block Island
White hake	NA	NA	NA	NA
Skipjack tuna	NA	NA	NA	NA
Thresher shark	NA	NA	Block Island	Block Island
Tiger shark	NA	NA	Block Island	NA
White shark	NA	NA	Block Island	Block Island
Witch flounder	Block Island	Block Island	NA	NA
Windowpane flounder	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound
Winter flounder	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound
Winter skate	NA	NA	Narragansett Bay Block Island Sound	Narragansett Bay Block Island Sound
Yellowtail flounder	Block Island	Block Island	Block Island	Block Island
Yellowfin tuna	NA	NA	Block Island	Block Island

[76] YOY (Young of the year): "All of the fish of a species that were born in the past year, from transformation to juvenile until January 1." (USEPA, 2015d)

Shellfish and Other Invertebrates

Rhode Island is home to both freshwater and marine shellfish. Well-known freshwater bivalve[77] species include the east elliptio mussel (*Elliptio complanata*), eastern floater (*Pyganodon cataracta*), alewife floater (*Anodonta implicata*), and triangle floater (*Alasmidonta undulata*). Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), other well-known Rhode Island freshwater invertebrates that spend their lives in aquatic systems include the white river crawfish (*Procambarus acutus*) and virile crayfish (*Orconectes virilis*) (RIDEM, 2015k).

Numerous marine shellfish and other invertebrates occur in the waters along and off the coast of Rhode Island. Bay scallops (*Argopecten irradians*) prefer shallow coastal bays and estuaries with sandy and muddy bottoms and eelgrass beds. Atlantic surf clams (*Spisula solidissima*) are found in sand and muddy sand seabeds from subtidal areas to approximately 100 feet deep. Eastern oysters (*Crassostrea virginica*) prefer intertidal and subtidal zones where rocky reefs dominate. Hard clams (*Mercenaria mercenaria*) are found along beaches and bays in sand or muddy sand. Longfin squid (*Doryteuthis pealeii*) are primarily caught in the ocean, but in the summer they can be caught inshore (RIDEM, 2015k).

American lobster (*Homarus americanus*) habitat extends on the ocean floor in the northwest Atlantic Ocean, both nearshore and distant waters. Lobsters are a common resident of Rhode Island’s rocky coastline, where they can capture prey and hide from predators in crevices. Blue crabs (*Callinectes sapidus*) feed and forage throughout local bays and estuaries when the water is warm. In winter months, crabs move into deeper waters and bury themselves, where they remain dormant until warmer temperatures return. In Rhode Island, Atlantic horseshoe crabs (*Limulus polyphemus*) occur year-round in Block Island Sound. Horseshoe crabs spawn in May and June, when thousands can be seen along the shorelines of Rhode Island. Horseshoe crabs are used by fisherman as bait and in the pharmaceutical industry. Rhode Island’s shellfish and other invertebrate species are recreationally and commercially harvested (RIDEM, 2015k).

Marine Mammals

All marine mammals (i.e., whales, dolphins, porpoises, seals, and sea lions) are protected under the MMPA and a subset are also protected under the ESA. Although not typically seen, three whale species may occasionally be observed offshore of Rhode Island and are listed as endangered: Finback (*Balaenoptera physalus*), Humpback (*Megaptera novaeangliae*), and North Atlantic Right Whale (*Eubalaena glacialis*). Three species of seals—gray, harbor, and harp seal (*Halichoerus grypus*; *Phoca vitulina*; *Pagophilus groenlandicus*)—can be found within Narragansett Bay off the mainland coast of Rhode Island. This section briefly introduces the marine mammal species found in the coastal waters of Rhode Island.

Many whale species occur offshore of Rhode Island as transient individuals as they migrate northward towards feeding grounds and southward towards warmer breeding grounds. Occasionally individuals are beached or stranded along the coast, but these are relatively rare

[77] Bivalve: “An aquatic mollusk whose compressed body is enclosed within a hinged shell.” (USEPA, 2015d)

occurrences. Their presence offshore is often unnoticed because of their transient nature and deep ocean preference.

A few species of whales exhibit distinctive behaviors. In contrast to migratory patterns displayed by other whale species, minke whales (*Balaenoptera acutorostrata*) breed during the summer months in the northern hemisphere; however, they spend very little time at the surface and are therefore rarely seen. Sei whales (*Balaenoptera borealis*) feed far offshore in the open ocean and are unlikely to approach nearshore areas.

The gray, harbor, and harp seal are full-time residents in the waters off Rhode Island commonly found within Narragansett Bay. Additionally, harbor seals may also be found upstream in mouths of rivers and even in some northern populations in freshwater lakes. During high tide, they ascend rivers with the tide to search for food. The harbor seals have limited seasonal movement (Whitaker, 1980).

Sea Turtles

Six species of sea turtles occur in U.S. waters, all of which are protected under the ESA. Three of these sea turtles occur in the waters off the coast of Rhode Island. For more information on sea turtles, refer to Section 13.1.6.6.

Invasive Aquatic Species

As previously discussed, Rhode Island has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase and introduction of select invasive species, both plants and animals.

Some of the more troublesome invasive aquatic species include the European green crab (*Carcinus maenas*), Asian shore crab (*Hemigrapsus sanguineus*), Asian clam (*Corbicula fluminea*), and several species of carp (*Cyprinus* spp.) (Aquatic Nuisance Species Task Force, 2007).

13.1.6.6. Threatened and Endangered Species and Species of Conservation Concern

The USFWS is responsible for administering the ESA (16 U.S.C §1531 et seq.) in Rhode Island. The USFWS New England Field Office has identified 5 endangered and 5 threatened species known to occur in Rhode Island (USFWS, 2015c). Of these listed species, none have federally designated critical habitat (USFWS, 2015d). The 10 federally listed species include 1 mammal, 3 reptiles, 3 birds, 1 invertebrate, and 2 plants[78] and are discussed in detail under the following sections (USFWS, 2015c).

[78] Note that the Rhode Island Department of Environmental Management lists the finback whale (*Balaenoptera physalus)*, the North Atlantic Right Whale (*Eubalaena glacialis*), the humpback whale (*Megaptera novaeangilae)* and the shortnose sturgeon (*Acipenser brevirostrum*) as occurring in Rhode Island (RIDEM, 2006); however, the USFWS does not list either species in Rhode Island. For purposes of this discussion, neither species will be discussed specifically as a threatened or endangered species in Rhode Island.

Mammals

One listed threatened mammal is known to occur in Rhode Island as summarized in Table 13.1.6-5. The northern long-eared bat occurs throughout the state. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Rhode Island is provided below.

Table 13.1.6-5: Federally Listed Terrestrial Mammal Species of Rhode Island

Common Name	Scientific Name	Federal Status[a]	Critical Habitat	Habitat Description
Terrestrial Mammals				
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Caves and tree crevices throughout Rhode Island

Source*:* (USFWS, 2015c)

[a] T = Threatened

Northern Long-eared Bat
Photo Credit: USFWS

Northern Long-eared Bat. The northern long-eared bat is a brown furred, insectivorous[79] bat with long ears. Reaching a total length of approximately three to four inches. It is a medium size relative to other members of the genus *Myotis*. The northern long-eared bat was first proposed as endangered in 2013 (78 FR 61046, October 2, 2013), and then listed as threatened in 2015 (80 FR 17973 18033, April 2, 2015). In the United States, its range includes most of the eastern and north central states (USFWS, 2015e). Locally, the northern long-eared bat's range includes the entire state of Rhode Island (USFWS, 2015e).

This species hibernates in caves and mines that exhibit constant temperatures, high humidity, and no air currents. In the summer, individuals roost[80] 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 following hibernation[81], from which pregnant females then migrate to summer areas where they roost in small colonies (USFWS, 2015e).

White Nose Syndrome is the leading cause for the decline of this species, as well as other bat species throughout the northeastern and eastern United States. The numbers of northern long-eared bats in hibernation sites (hibernacula) have decreased by up to 99 percent in the northeastern United States. Other threats include temperature or air flow impacts to their hibernating habitat, forest management practices that are incompatible with this species' habitat needs, habitat fragmentation,[82] and wind farm operations (USFWS, 2015e).

[79] Insectivorous: "An animal that feeds on insects." (USEPA, 2015d)
[80] Roost: "A place where a flying animal, usually a bird or bat, can sleep or rest, usually by perching or hanging." (USFWS, 2015i)
[81] Hibernation: "The act of passing the winter in a dormant state in which the metabolism is slowed to a tiny fraction of normal." (USFWS, 2015j)
[82] Fragmentation: "The breaking up of large and continuous ecosystems, communities, and habitats into smaller areas that are surrounded by altered or disturbed land or aquatic substrate." (USEPA, 2015d)

Reptiles

Two endangered and one threatened marine reptile, all sea turtles, occur within Rhode Island as summarized in Table 13.1.6-6. These sea turtles may be found off the coast of Rhode Island in the North Atlantic. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Rhode Island is provided below.

Table 13.1.6-6: Federally Listed Reptile Species of Rhode Island

Common Name	Scientific Name	Federal Status[a]	Critical Habitat	Habitat Description
Marine Reptiles				
Green Sea Turtle	*Chelonia mydas*	T	No	Coastal waters of the North Atlantic
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	No	Coastal waters of the North Atlantic
Leatherback Sea Turtle	*Dermochelys coriacea*	E	No	Coastal waters of the North Atlantic

Source: (USFWS, 2015c)

[a] E = Endangered, T = Threatened

13.1.6.7. Marine Reptiles

Green Sea Turtle. The green sea turtle occurs throughout tropical and subtropical oceans and is among the largest of the hard-shelled sea turtles growing to as much as 440 pounds and four feet in length. The breeding populations in Florida were listed as endangered in 1978 (43 FR 32800, July 28, 1978) whereas all other populations were listed as threatened (NOAA, 2015d). Regionally, green sea turtles are found from Maine south to Florida, and throughout the Gulf of Mexico and the Caribbean Sea (USFWS, 2015f) (USFWS, 2015g). There is a proposal for a North Atlantic green sea turtle distinct population that would be listed as threatened, continuing its current listing status near Rhode Island (80 FR 51763, August 26, 2015).

They are found in the shallow waters (except during migration) of shoals, bays, lagoons, reefs, and inlets, often where submerged aquatic vegetation exists (NOAA, 2015d). Breeding occurs in subtropical to tropical oceans every two to four years in the summe, with peak nesting in June and July (NOAA, 2015d) (USFWS, 2015f). Hatching usually occurs at night, and many green sea turtle hatchlings seek refuge and food in masses of floating sea plants (USFWS, 2015f).

The collection of green sea turtles for food was the primary cause for the decline of this species; however, current threats include disease, loss or degradation of nesting habitat; disorientation of hatchlings by lighting; nest predation; marine pollution; watercraft strikes; and incidental take from channel dredging and commercial fishing operations (USFWS, 2015f).

Green Sea Turtle Photo credit: USFWS

Hawksbill Sea Turtle. The hawksbill sea turtle is one of the smaller sea turtles. It was listed as endangered in 1970 (35 FR 8491, Jun 6, 1970). It has overlapping plates that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and rocks during storm events.

Adults range in size from 30 to 36 inches and weigh 100 to 200 pounds. Its upper shell is dark brown with faint yellow streaks and a yellow under shell. The hawksbill is found throughout all of the oceans of the world (USFWS, 2015h). Although hawksbill sea turtles are found in the Atlantic and in the continental U.S. as far north as Massachusetts, they are most common in Puerto Rico, its associated islands and the U.S. Virgin Islands (NOAA, 2015e).

This species prefers warm, shallow, coastal waters of reefs, lagoons, inlets, and bays with submerged aquatic vegetation. It is an omnivore, feeding mostly sponges and is most often associated with the coral reef community. Nesting occurs on remote beaches in the Gulf of Mexico and the Caribbean Sea in two to three year cycles (USFWS, 2015h).

Current threats to the hawksbill sea turtle include: accidental capture in fishing lines, vessel strikes, contaminants, oil spills, disease, habitat loss of coral reef communities, and commercial exploitation. Outside of the U.S., a current threat is the collection for meat, eggs, and parts, which was the historic threat to this species causing their decline (USFWS, 2013b).

Leatherback Sea Turtle. The leatherback sea turtle is “the largest and most migratory and wide ranging of all sea turtles,” found in all of the world’s oceans (USFWS, 2015i). It was listed as endangered in 1970 (35 FR 8491, June 2, 1970) and was grandfathered into the ESA of 1973 (Harrington, 1982). The leatherback sea turtle ranges as far north as the Gulf of Maine and Newfoundland (USFWS, 2015i) (USFWS, 2015j).

Their diet consists of jellyfish and squid and while they may forage in coastal waters but they prefer open sea environments (USFWS, 2015j) (NOAA, 2015f). Female leatherback sea turtles nest at 2 to 3 year intervals on beaches composed of coarse sand that are adjacent to deep water and subject to erosion (USFWS, 2015j). Major threats to the species include harvesting of their eggs, hunting, their incidental capture in fishing gear, and consumption of plastics that were mistaken for jellyfish (NOAA, 2015f).

Birds

One endangered two one threatened bird species occur within Rhode Island as summarized in Table 13.1.6-7. The roseate tern (*Sterna dougallii dougallii*) was historically found on state beaches, and the red knot (*Calidris canulus rufa*) and piping plover (*Charadrius melodus*) are found on the North Atlantic coast in growing numbers. Information on the habitat, distribution, and threats to the survival and recovery of these species in Rhode Island is provided below.

Table 13.1.6-7: Federally Listed Bird Species of Rhode Island

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Piping Plover	*Charadrius melodus*	T	No	Beaches of North Atlantic and Block Island Sound
Red knot	*Calidris canutus rufa*	T	No	Coastal areas of the Gulf of Maine
Roseate Tern	*Sterna dougallii*	E	No	Beaches of coastal islands

Source: (USFWS, 2015c)

[a] E = Endangered, T = Threatened

Piping Plover. The piping plover is a small, pale-colored shorebird with a short beak and black band across the forehead, listed as endangered in 1985 (50 FR 50726, Dec 11, 1985) for the Great Lakes watershed of both the U.S. 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 Virgin Islands (USFWS, 2015k). Piping plovers breed in three geographic regions of North America, composed of two separate subspecies (USFWS, 2015l). Those breeding within the northeastern U.S. and Canada are of the subspecies *C. m. melodus*, whose range extends from the Atlantic to the Great Lakes themselves (USFWS, 2015m). In Rhode Island, piping plovers are protected at 13 USFWS managed beaches, and in 2015, 74 pairs fledged 94 chicks between March and August 2015 (USFWS, 2015l) (USFWS, 2015n).

Piping Plover Photo credit: USFWS

This species feeds in the intertidal zone of ocean beaches, ocean washover areas, mudflats, sandflats, wrack lines, and the shorelines of coastal ponds, lagoons, and salt marshes. They feed on worms, fly larvae, beetles, crustaceans, and other marine macroinvertebrates (USFWS, 2015n). Current threats to this species include habitat loss and habitat degradation, human disturbance, pets, predation[83], flooding from coastal storms, and environmental contaminants (USFWS, 2015n).

Red Knot Photo credit: USFWS

Red Knot. Federally listed as a threatened species in 2014 (79 FR 73705, December 11, 2014), the red knot is a large sandpiper that flies in large flocks along Delaware Bay and the Atlantic coast each spring. Red knots spend their winters in the southern tip of South America, northern Brazil, the Caribbean, and the southeastern and Gulf Coasts of the U.S. and breed in the tundra of the central Canadian Arctic. Some have been documented to migrate more than 9,300 miles from south to north every spring and return south in autumn. Red knots are infrequently observed in Rhode Island. The species is primarily observed here during migration periods when they are moving either to or from breeding areas in the Canadian Arctic (NHFG, 2015h) (USFWS, 2015o).

The preferred habitat for the red knot is intertidal marines, estuaries, and bays. The red knot stops along the New England coast during the spawning season for the horseshoe crab (*Limulus polyphemus*) and mussel beds, which are important food sources to the species (USFWS, 2005). 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 (NHFG, 2015h) (USFWS, 2015o).

[83] Predation: "The act or practice of capturing another creature (prey) as a means for securing food." (USEPA, 2015d)

Roseate Tern. The roseate tern is approximately 16 inches in length with light-gray wings and a black cap. During breeding season, the roseate tern's white chest gains a rosy tinge on the chest, and its bill and legs turn from black to orange-red (USFWS, 2011). The tern was listed as endangered in 1987 in the Northeast region and threatened in the southeast region (52 FR 42064, November 2, 1987) (USFWS, 2015p). The species is a marine bird that breeds along the coasts on salt marsh islands and beaches with sparse vegetation (USFWS, 2011). In general, the species is present along the coasts of the Atlantic, Pacific, and Indian Oceans. In eastern North America, the roseate tern breeds from the Canadian maritime provinces south to New York (USFWS, 2011).

Rhode Island is a part of the roseate tern's historic range, but the species pass through during its migrations, preferring breeding colonies in New York and Massachusetts where they number in the thousands (USFWS, 2013c). This species was almost hunted to extinction for the millinery trade (e.g., for feathers used in women's hats). Present threats include vegetation changes in breeding areas, competition with gulls for suitable nest sites, and predation (USFWS, 1998).

Invertebrates

One federally listed endangered invertebrate species occurs within Rhode Island as summarized in Table 13.1.6-8. The American burying beetle (*Nicrophorus americanus)* is found on Block Island in Block Island Sound. Information on the habitat, distribution, and threats to the survival and recovery of this species in Rhode Island is provided below.

Table 13.1.6-8: Federally Listed Invertebrate Species of Rhode Island

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
American Burying Beetle	*Nicrophorus americanus*	E	No	Grasslands of Block Island

Source: (USFWS, 2015c)
[a] E = Endangered

American Burying Beetle. The American burying beetle is the largest carrion beetle in North America with a length of between one to two inches with a shiny black shell, smooth shiny black legs, with pronounced orange markings on its body and orange club shaped antennae. The beetle buries carcasses to feed its larvae and upon which it feeds while caring for its young. The species was listed as endangered in 1989 (54 FR 29652, July 13, 1989) (USFWS, 1991).

The American burying beetle can be found in flat topography with forest litter and decomposing plant matter in the top layers of well-drained soil. Historically the species ranged in more than 150 counties in 35 states of the eastern and central U.S. (USFWS, 1991) but today is found in five distinct populations across 10 states. In 2012, Missouri established a non-essential experimental population with efforts to reintroduce the American burying beetle. In Rhode Island, the American burying beetle is found in Washington County on Block Island, where a 1990 survey estimated 612 beetles. Threats to the species include habitat loss, fragmentation, and overall loss of reduction of small vertebrates to host the species (USFWS, 1991).

Plants

One endangered and one threatened plant are federally listed for Rhode Island as summarized in Table 13.1.6-9. The sandplain gerardia *(Agalinis acuta)* is found at one site in Washington County and the small whorled pogonia *(Isotria medeoloides)* is found in shady forests in the northern state portion of the state. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Rhode Island is provided below.

Table 13.1.6-9: Federally Listed Plant Species of Rhode Island

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Sandplain Gerardia	*Agalinis acuta*	E	No	Grasslands throughout the state
Small Whorled Pogonia	*Isotria medeoloides*	T	No	Forest of north eastern Rhode Island

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

Sandplain Gerardia. Sandplain gerardia was federally listed as endangered in 1988 (53 FR 34701, September 7, 1988). It is a light yellowish green annual with pink blossoms which only bloom for a day and then drop their petals. Historically, six populations were reported in Rhode Island, however only one remains currently. This population lies within a cemetery and continued mowing provides periodic disturbances which are necessary for the species' success (USFWS, 1989). Preferred habitats are sandy soils of grasslands and roadsides, in pine/oak scrubs, and on scattered patches of bare soils. They cannot survive on their own and require a relationship with the little bluestem (*Schizachyrium scoparium*). Threats to this species include habitat loss from succession, fire suppression, land development, and invasive competitors (NHESP, 2011).

Small Whorled Pogonia. The small whorled pogonia is a member of the orchid family which grows between 10 to 14 inches in height with greenish yellow flowers. The small whorled pogonia was federally listed as endangered in 1982 (47 FR 39827, September 9, 1982) and in 1994 was reclassified as threatened (59 FR 50852, October 6, 1994) (USFWS, 2015q). Regionally, this species is known to occur sparsely distributed from Maine south to Georgia and east to Illinois (USFWS, 2008). Locally, the small whorled pogonia may be found in a forests of Providence County (USFWS, 1992).

The small whorled pogonia occurs in hardwood stands that have an open understory, preferring acidic soils along small streams that have a thick layer of litter (USFWS, 2008). Small whorled pogonias bloom in May to June, producing a single tiny yellowish or greenish flower that lasts for seven days (Newcomb, 1977). One distinct feature of this species is that it can remain dormant underground for 10 to 20 years before reappearing (Peterson & McKenny, 1968). Current threats to small whorled pogonia include habitat loss due to urban expansion and forestry practices (USFWS, 2008).

13.1.7. Land Use, Recreation, and Airspace

13.1.7.1. Definition of the Resource

The following summarizes major land uses, recreational venues, and airspace considerations in Rhode Island, 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, 2012d).

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, beaches, caves, lakes, forests, 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.

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 responsible for the safe and efficient use of the nation's airspace and has established criteria and limits to its use.

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

Mexico" (FAA, 2014a). The ATO is 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 [FSDOs], Regional Offices & Aeronautical Center, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (FAA, 2015b). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

13.1.7.2. Specific Regulatory Considerations

Appendix C summarizes numerous federal laws and regulations that, to one degree or another, affect land use in Rhode Island. However, most site-specific land use controls and requirements are governed by county, city, and local laws and regulations. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities (Table 13.1.7-1).

Table 13.1.7-1: Relevant Rhode Island Land Use Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
State Guide Plan	Rhode Island Department of Administration, Division of Planning	A series of documents "centralizing the integrating long-range goals, policies, and plans," including Rhode Island Land Use policies.

Source: (State of Rhode Island, 2002)

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

13.1.7.3. Land Use and Ownership

For the purposes of this analysis, Rhode Island has been classified into three primary land use groups: forest and woodlands, agricultural, and developed land. Land ownership within Rhode Island has been classified into four main categories: private, federal, state, and tribal.

Land Use

Table 13.1.7-2 identifies the major land uses in Rhode Island. Forest and woodlands make up the largest portion of land use with 35 percent of Rhode Island's total land occupied by this category (Table 13.1.7-2 and Figure 13.1.7-1). Developed land is the second largest area of land use with 16 percent of the total land area followed by agricultural land with 4 percent. The remaining percentage of land and other land cover, shown in Figure 13.1.7-1, that are not associated with specific land uses (USGS, 2012e).

Table 13.1.7-2: Major Land Uses in Rhode Island

Land Use	Square Miles	Percent of Land
Forest and Woodland	640	35%
Agricultural Land	70	4%
Developed Land	292	16%
Open Water and Wetlands	788	43%

Source: (USGS, 2012e)

Forest and Woodland

While forests are found throughout Rhode Island, contiguous forested areas are located in the western part of the state. These areas are in forests and wildlife management areas owned and managed by the state. Most forest and woodland areas in Rhode Island are privately owned (approximately 85 percent) (USFS, 2011). Section 13.1.6.3, Terrestrial Vegetation, presents additional information about terrestrial vegetation.

Private Forest and Woodland

Approximately 27,000 private landowners collectively own approximately 85 percent of Rhode Island's forest (USFS, 2011) (USFS, 2002). Approximately 21,000 owners have less than 10 acres of forestland while less than 50 owners have more than 500 acres. These private forests provide wood products, wildlife habitat, recreation opportunities, and hunting (Rhode Island, Department of Administration, Division of Planning Statewide Planning Program, 2005). For additional information regarding forest and woodland areas, see Section 13.1.6.3, Terrestrial Vegetation and Section 13.1.8, Visual Resources.

Agricultural Land

Agricultural land is dispersed throughout Rhode Island (Figure 13.1.7-1). Approximately 6.6 percent of Rhode Island's total land area is classified as agricultural land (70 square miles). In 2012, there were 1,243 farms in Rhode Island. Families and individuals own more than 75 percent of the farms with an average farm size of 56 acres. The state's largest agricultural products by market value are dairy, sweet corn, hay, potatoes, and apples. Other agricultural products include aquaculture (seafood), cattle, grains, and hogs (USDA, 2012). For more information by county, access the USDA Census of Agriculture website: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Rhode_Island/.

Developed Land

Developed land in Rhode Island is concentrated within metropolitan areas and surrounding cities, towns, and suburbs (Figure 3.1.7-3). Approximately 16 percent of Rhode Island land is developed. These areas consist of residential, commercial, and industrial uses. Table 13.1.7-3 lists the two metropolitan areas within the state and their associated population estimates, and Figure 3.1.7-3 shows where these areas are located within the developed land use category.

Table 13.1.7-3: Top Two Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Norwich-New London CT-RI	273,676
Providence-Warwick RI-MA	1,609,367
Total Population of Metropolitan Areas	1,883,043[a]
Total State Population	1,055,173

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

[a] Total Population of Metropolitan Areas includes the population of other states within the metropolitan areas identified in the table.

Land Ownership

Land ownership within Rhode Island has been classified into four main categories: private, federal, state, and tribal.

Private

The majority of the land in Rhode Island is privately owned, with most the private land falling under the land use categories of forest and woodland, developed, and agriculture (Figure 13.1.7-2). Private land exists in all regions of the state.[84]

Federal

The federal government manages 33.6 square miles (three percent) of Rhode Island land including military bases, National Wildlife Refuges, and a National Memorial (Figure 13.1.7-2) (USGS, 2014i). Three federal agencies manage federal lands in Rhode Island (Table 13.1.7-4)

Table 13.1.7-4: Federal Land in Rhode Island

Agency[a]	Square Miles	Representative Type
Department of Defense	30.1	Military Bases
U.S. Fish and Wildlife Service	3.5	National Wildlife Refuges
National Park Service[b]	<1	National Memorial
Total	33.6	

Source: (USGS, 2014i)

[a] Table identifies land wholly managed by the Agency; additional properties may be managed by or affiliated with the Agency
[b] Additional trails and corridors pass through Rhode Island that are part of the National Park System

The DoD owns and manages 30.1 square miles used for military bases, particularly Naval Station Newport. The USFWS owns and manages 3.5 square miles consisting of five National Wildlife Refuges in Rhode Island all located within the Rhode Island National Wildlife Refuge Complex. The National Park Service owns and manages less than one square mile (3.7 acres) consisting of two national parks.[85]

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

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

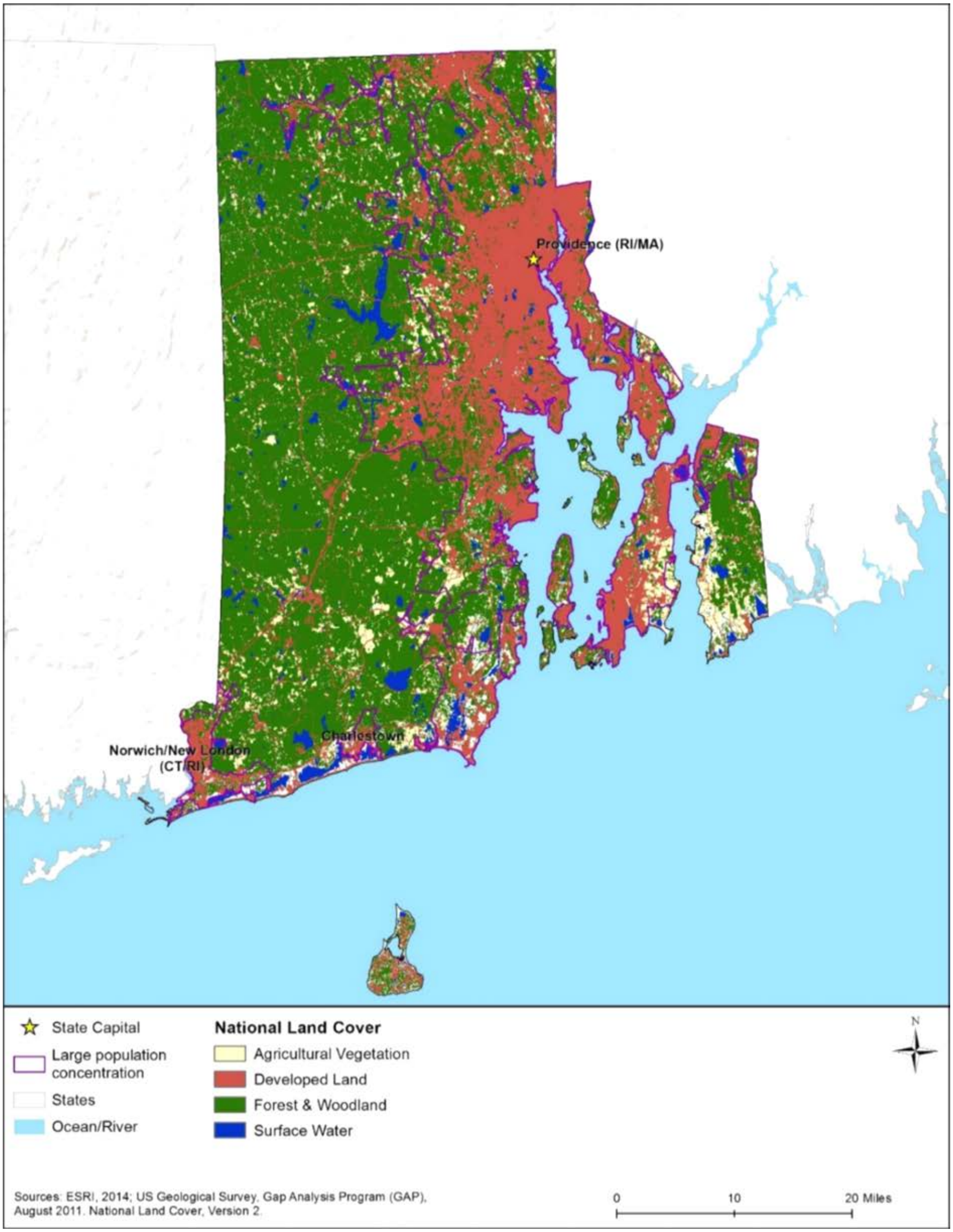

Figure 13.1.7-1: Land Use Distribution

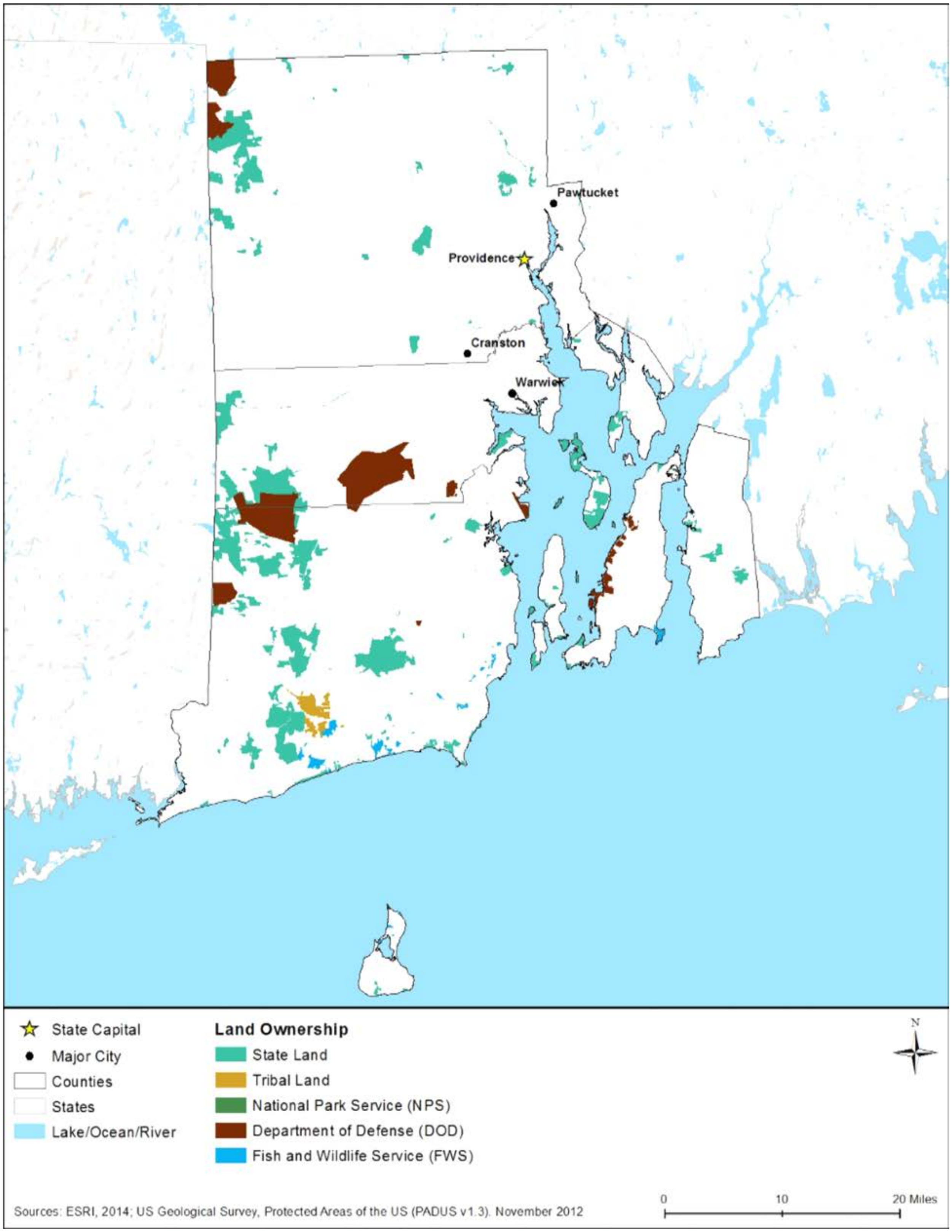

Figure 13.1.7-2: Land Ownership Distribution

State

The Rhode Island state government owns approximately 81.4 square miles of land consisting of 24 wildlife management areas managed by RIDEM (RIDEM, 2015o).

Tribal

The Bureau of Indian Affairs, along with the Narragansett Indian Tribe of Rhode Island, manages 3.9 square miles or less than 0.3 percent of the total land within Rhode Island. These lands include the Narragansett Indian Reservation, located in southern Rhode Island, in the town of Charlestown (see Figure 13.1.11-3) (USEPA, 2014c). For additional information regarding tribal land, see Section 13.1.11, Cultural Resources.

13.1.7.4. Recreation

Rhode Island is the smallest state in the United States and one of the most densely populated states, ranking 42nd of 50 (RI.gov, 2015a; The Nature Conservancy and the Rhode Island Department of Environmental Management, 2015). Rhode Island's recreation is primarily defined by its geography: the Narragansett Bay, Rhode Island Sound, Block Island Sound, and other bays and inlets border the state. On the community level, towns, cities, and counties provide an assortment of indoor and outdoor recreational facilities, including athletic fields and courts, playgrounds, picnicking areas, and public beaches. Availability of community-level facilities is typically commensurate to the population's needs.

This section discusses recreational opportunities available at various locations throughout Rhode Island. For information on visual resources, see Section 13.1.8, Visual Resources, and for information on the historical significance of locations, see Section 13.1.11, Cultural Resources.

Rhode Island contains over 100 beaches along the shores of the Rhode Island Sound, Block Island Sound, Narragansett Bay, and many other bays and inlets for which the state is known (Rhode Island Tourism Division, 2015). The East State Beach on the Quonochontaug Neck is a barrier beach with camping, swimming, clamming, fishing, and boating (Rhode Island Division of Parks and Recreation, 2012a). Roger W. Wheeler State Beach on the Block Island Sound has swimming, picnicking facilities, and an environmental education area (Rhode Island Division of Parks and Recreation, 2012b).

The John H. Chafee Blackstone River Valley National Heritage Corridor follows the Blackstone River from Worcester, MA to Providence, RI, where historic mill villages line the river and its tributaries. The Blackstone River Bikeway follows the river through 11.5 miles of off-road bike path have been completed in Rhode Island along the Blackston River Greenway, with stops for Visitor Centers and historic places. On the river, catch-and-release fishing, boating, canoeing and kayaking are popular activities (Blackstone Heritage Corridor, 2015).

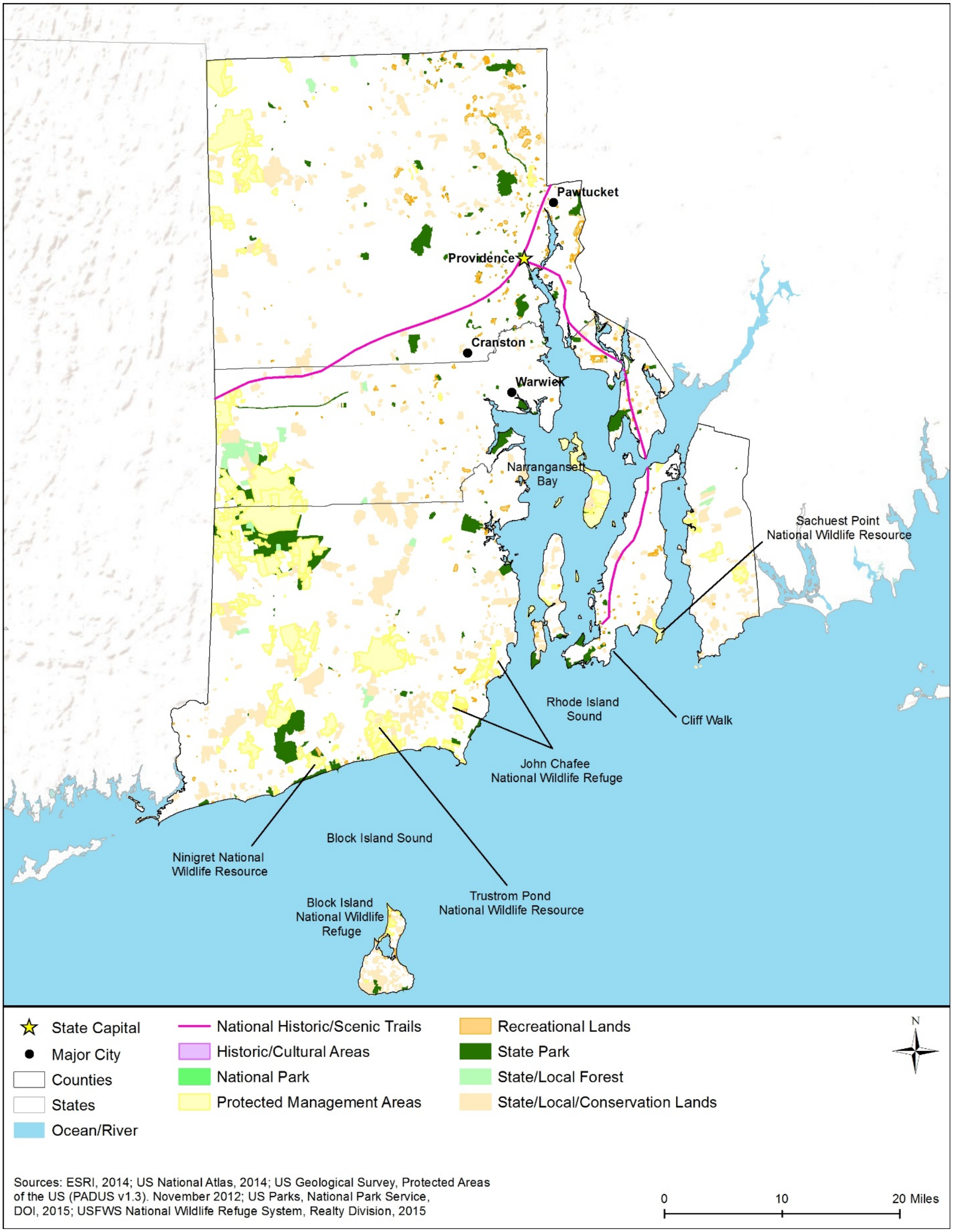

Figure 13.1.7-3: Rhode Island Recreation Resources

Rhode Island is home to five National Wildlife Refuges, four located on the coast (John Chafee; Ninigret; Sachuest Point, and Trustrom Pond) and one on Block Island (Block Island). Shoreline, freshwater pond, and saltwater pond fishing, including fly fishing and spearfishing, is permitted at Sachuest Point, Ninigret, and Block Island; John H. Chafee allows fishing although shoreline access is limited. Block Island, Ninigret, and Trustrom Pond are open for seasonal, licensed hunting. All refuges have interpretive and environmental education programs (USFWS, 2015r) (USFWS, 2015s) (USFWS, 2015t) (USFWS, 2015u) (USFWS, 2015v).

The Cliff Walk, a 3.5-mile National Recreation Trail, runs along the eastern shore of Newport. The Walk is a public right-of-way over private property, and is notable for passing between the shore and mansions built in the late 1800's (Friends of the Waterfront, 2015).

13.1.7.5. Airspace

The FAA uses the NAS to provide for aviation safety. The NAS includes Special Use Airspace (SUA) consisting of Restricted Areas, Warning Areas, and Military Operation Areas (MOAs). The FAA controls the use of the NAS with various procedures and practices (such as established flight rules and regulations, airspace management actions, and air traffic control procedures) to ensure the safety of aircraft and protection of the public.

Airspace Categories

There are two categories of airspace or airspace areas.

1) **Regulatory airspace** consists of controlled airspace (Class A, B, C, D, and E airspace areas in descending order of restrictive operating rules), and restricted and prohibited areas.
2) **Non-regulatory airspace** consists of MOAs, warning areas, alert areas, and controlled firing areas.

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 13.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[86] service is based on the airspace classification." (FAA, 2008).

[86] ATC – Approved authority service to provide safe, orderly and expeditious flow of air traffic operations. (FAA, Federal Aviation Administration Aeronautical Information Manual, 2014)

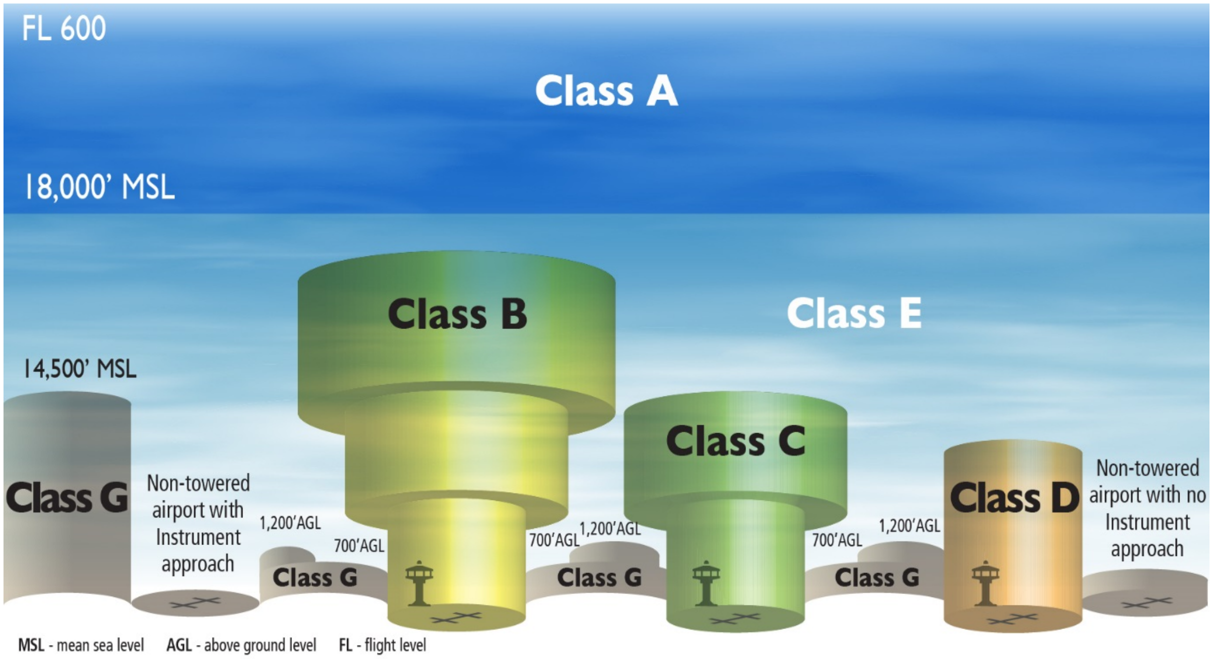

Figure 13.1.7-4: National Air Space Classification Profile

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[87]. 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).[88]
- **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).

[87] 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." (Sea Level 2015)
[88] 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)

SUA designates specific airspace that confines or imposes limitations on aircraft activities (Table 13.1.7-5).

Table 13.1.7-5: 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 (CFAs)	"Activities that, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart CFAs since they do not cause a nonparticipating aircraft to change its flight path."
National Security Areas (NSA)	"Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 99.7. Regulatory prohibitions are issued by System Operations, System Operations Airspace and Aeronautical Information Manual (AIM) Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

Source: (FAA, 2015d) (FAA, 2008)

Other Airspace Areas

Other airspace areas, explained in Table 13.1.7-6, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 13.1.7-6: Other Airspace Designations

Type	Definition
Airport Advisory	There are 3 types: Local Airport Advisory – Operated within 10 statute miles of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: Protect people and property from a hazard; Provide safety for disaster relief aircraft during operations; Avoid unsafe aircraft congestion associated with an incident or public interest event; Protect the U.S. President, Vice President, and other public figures; Provide safety for space operations; and Protect in the state of Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of "permanent" are included in this Draft PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.
Published VFRs and IRs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

Sources: (FAA, 2015d) (FAA, 2008)

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.

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, 2015e)

Construction or alternative facilities (such as towers) that are subject to FCC licensing requirements are also required to have an OE/AAA performed by the FAA Airport Division.

Rhode Island Airspace

Airport Planning resides within the Transportation Section of the State of Rhode Island Division of Planning, Department of Administration. While the Department of Transportation owns the airports, the management and operation of the six state-owned airports is handled by the Rhode Island Airport Corporation (RIAC) (Rhode Island Government 2015). The RIAC was started in 1992 to "develop the state aviation system in an efficient and effective manner" (Rhode Island Government 2015). The Rhode Island State Airport System Plan, Guide Plan Element 640, approved in September 2011, presents the strategic plan out through 2021 for maintaining an airport system that meets transportation and economic requirements. The Airport System Plan serves as the basis for balancing and integrating the six state-owned airports including the operational needs and improvements (Rhode Island Government 2011). There are no FAA FSDOs for Rhode Island (FAA, 2015b).

Rhode Island airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP addresses the strategic planning and future development for the state's airport system, as well as addressing key issues associated with their airports (National Association of State Aviation Officials (NASAO) 2015). Figure 13.1.7-5 presents the different aviation airports/facilities located in Rhode Island, while Figure 13.1.7-6 and Figure 13.1.7-7 present the breakout by public and private airports. There are approximately 24 airports (public and private) within Rhode Island as presented in Table 13.1.7-7 and Figure 13.1.7-5 through Figure 13.1.7-7 (BTS, 2015).

Table 13.1.7-7: Type and Number of Rhode Island Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	7	2
Heliport	1	13
Seaplane	0	1
Ultralight	0	0
Balloonport	0	0
Gliderport	0	0
Total	8	16

Source: (BTS, 2015)

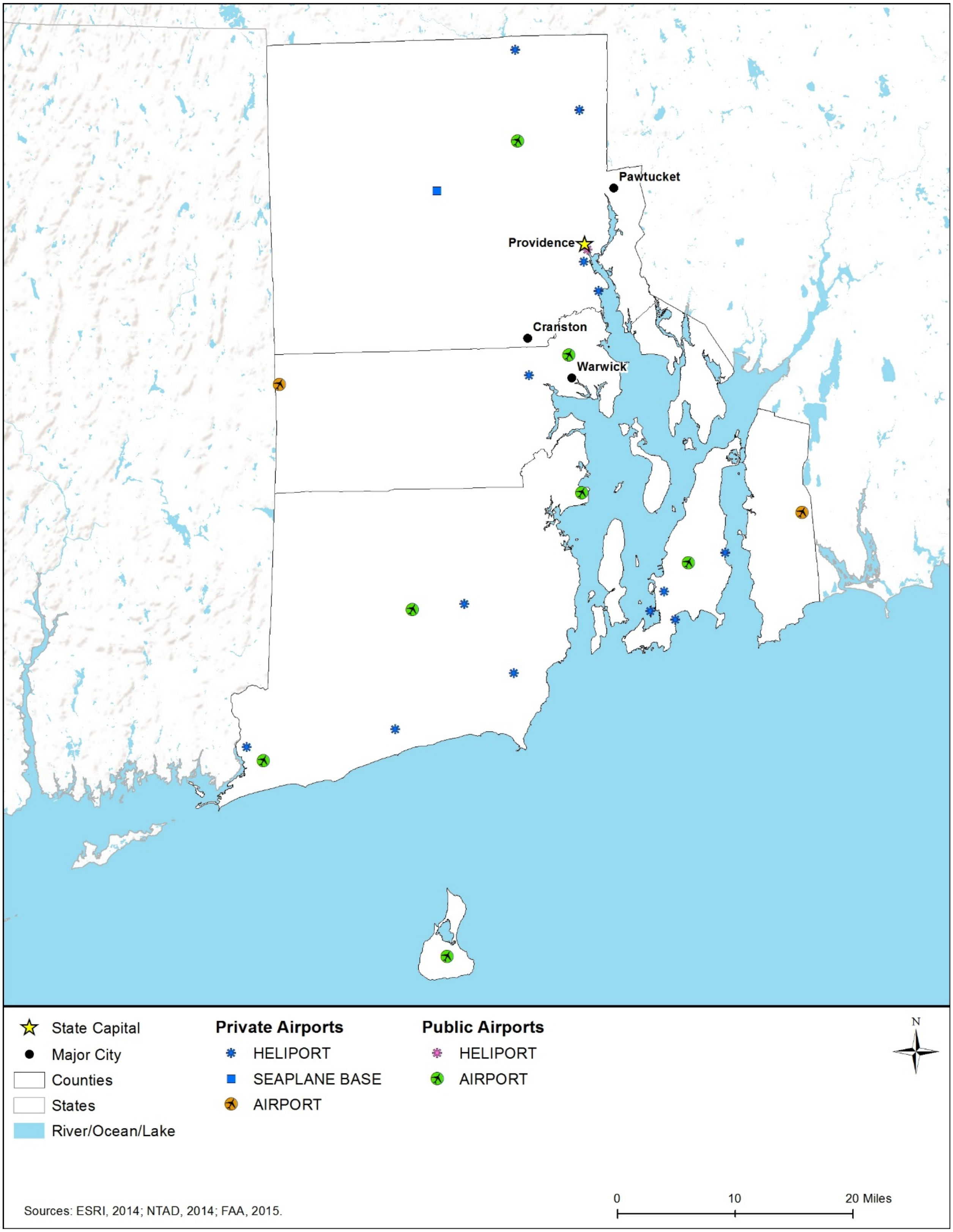

Figure 13.1.7-5: Composite of Rhode Island Airports/Facilities

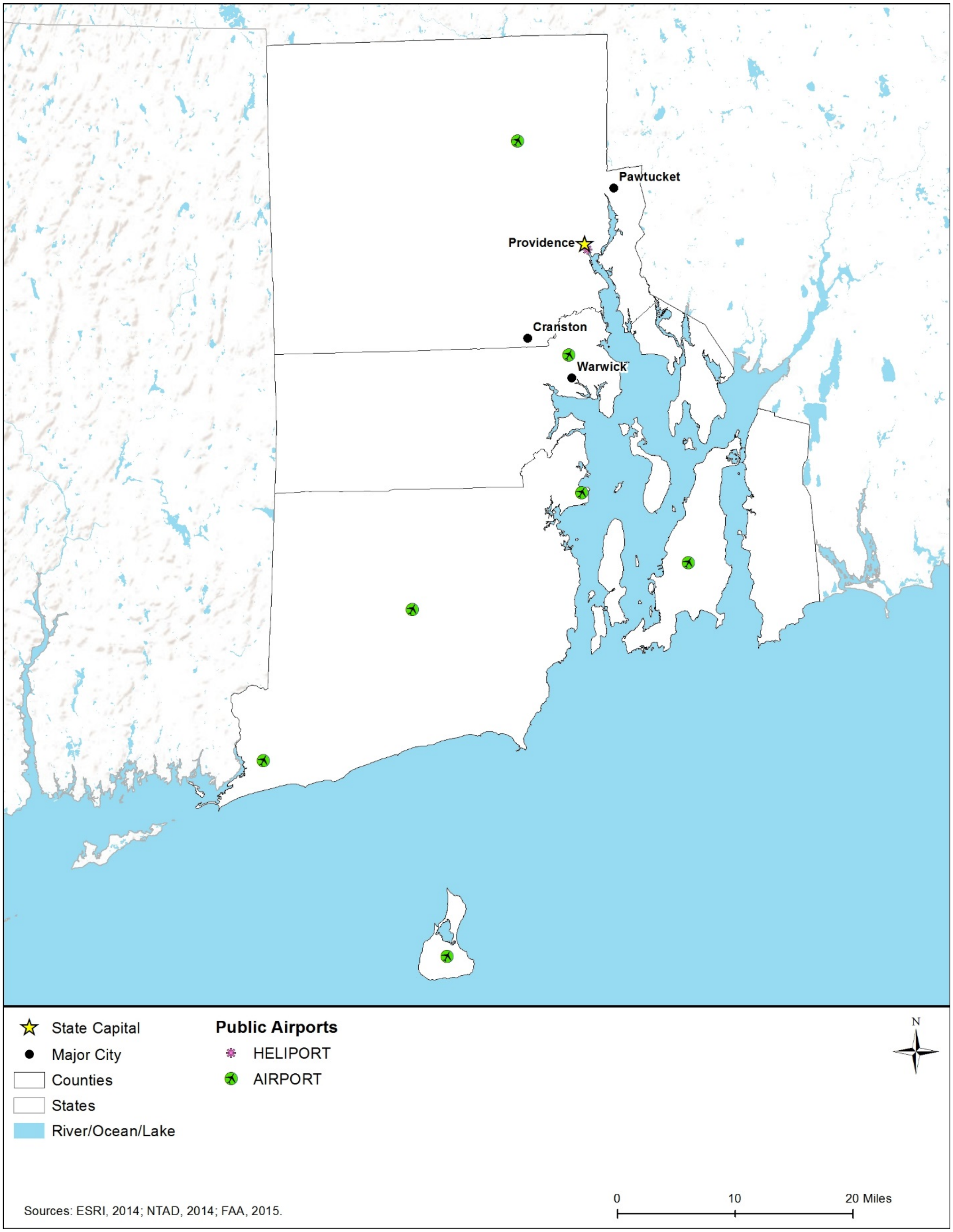

Figure 13.1.7-6: Public Rhode Island Airports/Facilities

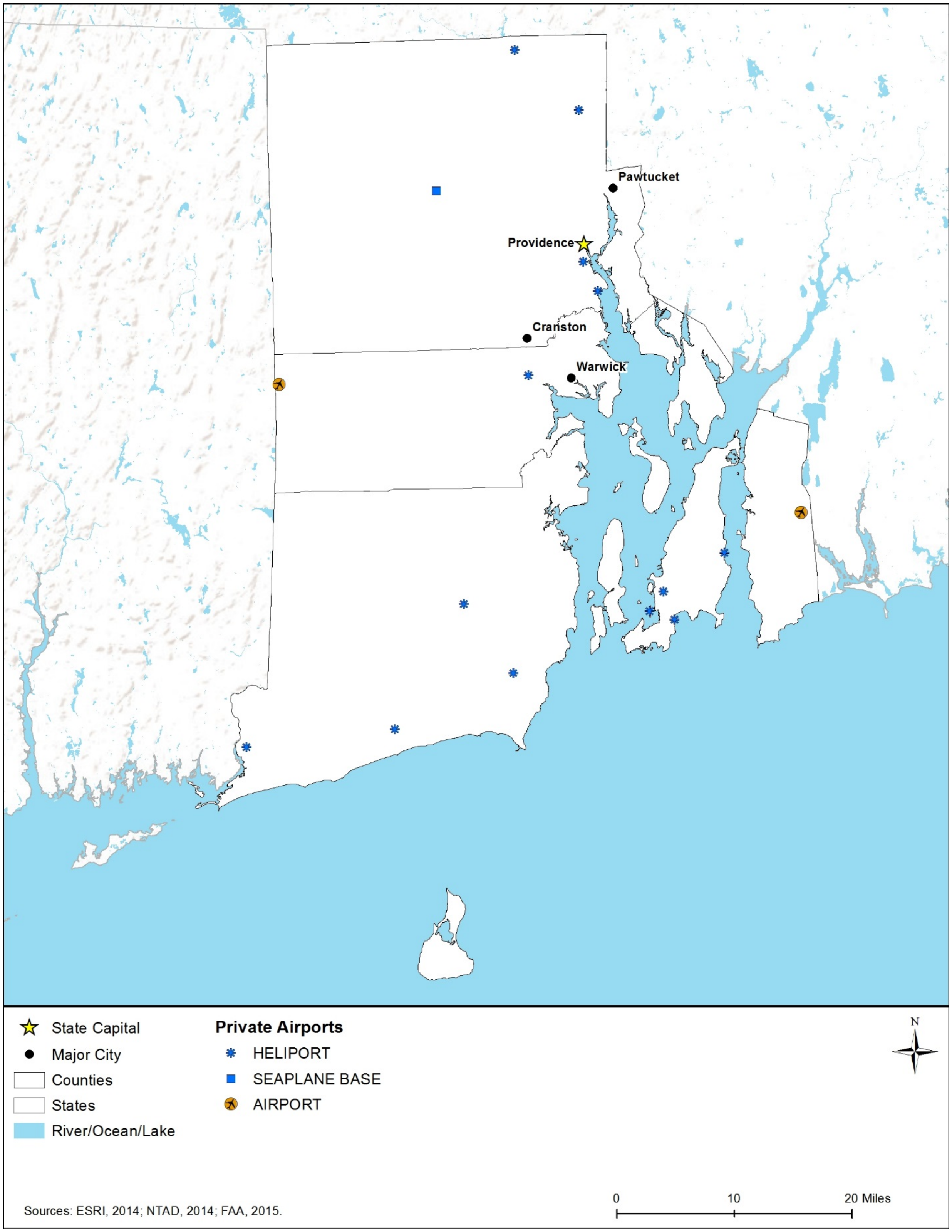

Figure 13.1.7-7: Private Rhode Island Airports/Facilities

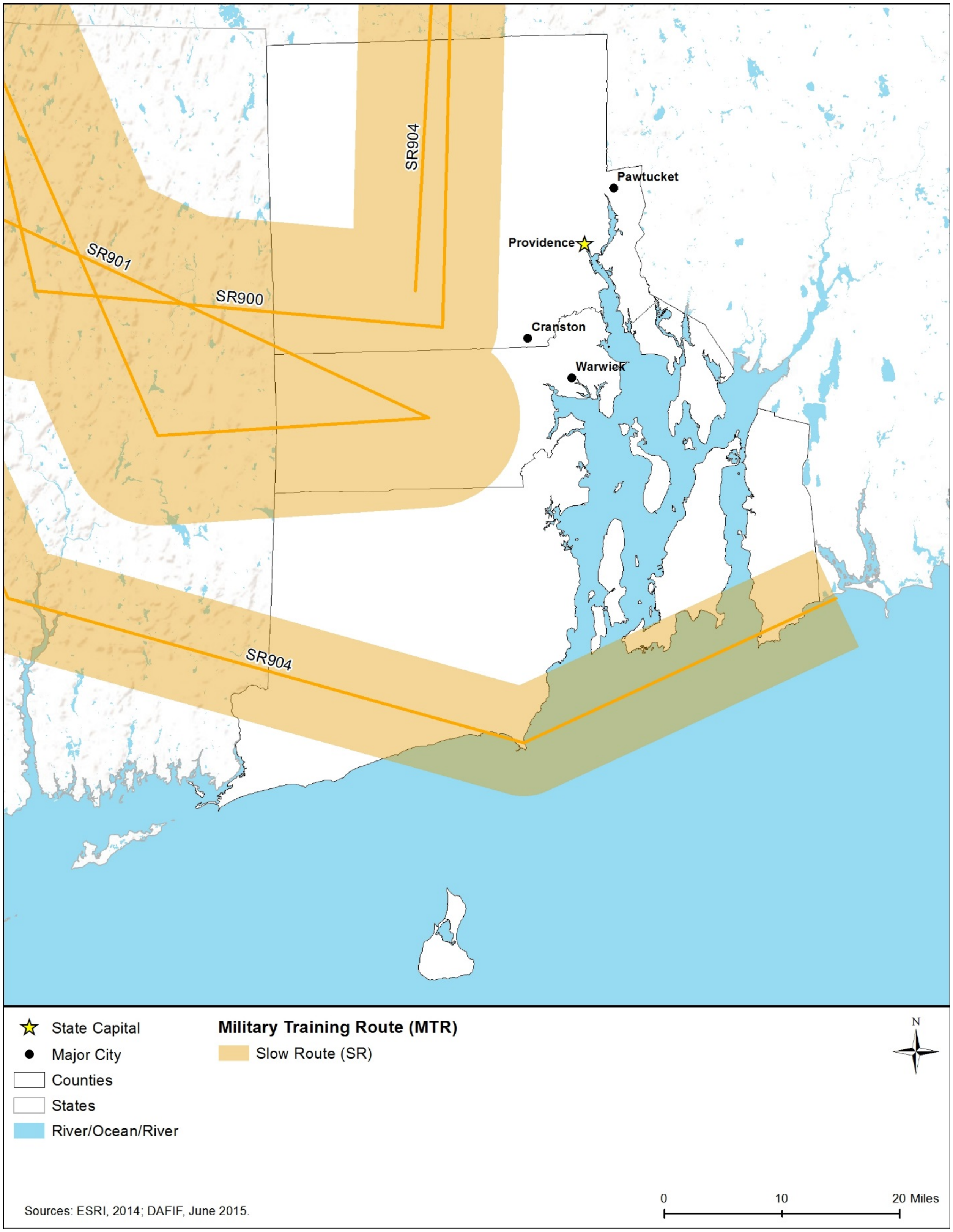

Figure 13.1.7-8: MTRs in Rhode Island

There are Class C, D, and E controlled airports for the State of Rhode Island as follows:

- One Class C – Providence, Theodore Francis Green State Airport
- One Class D – North Kingstown Quonset State Airport
- One Class E – Providence, Theodore Francis Green State Airport (FAA, 2014b)

There are no SUAs or TFRs located in Rhode Island (FAA, 2015f). Figure 13.1.7-8 presents the MTRs (Slow Routes 900, 901, and 904) in Rhode Island.

UAS Considerations

The National Park Service (NPS) signed a policy memorandum on June 24, 2014 that "directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service" (NPS, 2014a). There are two national parks[89] in Rhode Island (NPS, 2015c).

13.1.8. Visual Resources

13.1.8.1. 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 National Historic Preservation Act (NHPA) compliance. A general definition of visual resources used by the Bureau of Land Management is "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)" (BLM, 1984).

13.1.8.2. Specific Regulatory Considerations

Table 13.1.8-1 presents state and local laws and regulations that relate to visual resources for Rhode Island.

Table 13.1.8-1: Relevant Rhode Island Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Rules and Regulations of the Natural Heritage Preservation Commission of the State of Rhode Island and Providence Plantations	Natural Heritage Preservation Commission	"To insure the long-term preservation of irreplaceable open land resources and their recreational use by the public"

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

State Law/Regulation	Regulatory Agency	Applicability
The State of Rhode Island Coastal Resources Management Program	Coastal Resources Management Council	Approved by NOAA in 1978, the Program administered by the Rhode Island Coastal Resources Management Council, the primary authority under the Coastal Resources Management Act of 1971. Coastal zone encompasses the entire state, although the inland extent of the coastal management program's regulatory authority is generally 200 feet inland from any coastal feature.
Rhode Island Comprehensive Planning and Land Use Act 45-22.2-6	Rhode Island Statewide Planning Program	"Required content of a comprehensive plan (5) Historical and cultural resources identification and protection: The plan must be based on an inventory of significant historical and cultural resources such as historical buildings, sites, landmarks, and scenic views. The plan must include goals, policies, and implementation techniques for the protection of these resources."
Rhode Island Zoning Enabling Act 45-24	Rhode Island Statewide Planning Program	45-24-30. "General purposes of zoning ordinances (5) Providing for the protection of the natural, historic, cultural, and scenic character of the city or town or areas in the municipality." 45-24-33 "Standard provisions. – (a) A zoning ordinance addresses each of the purposes stated in § 45-24-30 and addresses, through reasonable objective standards and criteria, the following general provisions (3) Regulating the development adjacent to designated scenic highways, scenic waterways, major thoroughfares, public greenspaces, or other areas of special public investment or valuable natural resources."
State Guide Plan Element 162, the Rivers Policy and Classification Plan	Rhode Island Rivers Council	"A guide to protect and enhance the quality and the use of Rhode Island's rivers and waterbodies…it endeavors to integrate water quality planning with land use planning and with planning for activities such as recreation and habitat preservation."
State Guide Plan Element 152, Ocean State Outdoors: Rhode Island's Comprehensive Outdoor Recreation Plan	Rhode Island Statewide Planning Program and RIDEM	"A comprehensive plan for outdoor recreation, conservation and open space, including scenic resources."
State Guide Plan Element 121, Land Use 2025: Rhode Island State Land Use Policies and Plan	Rhode Island Statewide Planning Program	"The plan sets forth a statewide plan, with goals, policies, objectives, and strategies, for land use, conservation, and development. The purpose of the plan is to guide future land use and development and to present State Guide Plan policies under which State and local land development activities will be reviewed for consistency."

Sources: (The Natural Heritage Preservation Commission, 2001) (NOAA, 2015g) (Rhode Island Department of Administration, Division of Planning Statewide Planning Program, 2014) (Rhode Island Department of Administration, Division of Planning Statewide Planning Program, 2004) (Rhode Island, Department of Administration, Division of Planning Statewide Planning Program, 2009) (Rhode Island Department of Administration, Division of Planning Statewide Planning Program, 2006)

Rhode Island has numerous plans and policies in place to directly and indirectly protect scenic and visual resources (Table 13.1.8-1). RIDEM also conducted an inventory of scenic resources for the entire state, mapping the "most highly scenic" areas. The landscape inventory grew from legislation to "establish and maintain a list of scenic areas in the state." The information and data gathered from the inventory are available to assist the towns and cities of Rhode Island with future planning efforts, and to protect open space and scenic resources (Pascarella, 2015).

13.1.8.3. Character And Visual Quality Of The Existing Landscape

Rhode Island is the smallest state in the United States covering 1,034 square miles (U.S. Census Bureau, 2015f), and is one of the most densely populated states, ranking 42nd of 50 (RI.gov, 2015a; The Nature Conservancy and the Rhode Island Department of Environmental Management, 2015). While the state is small in size, Rhode Island contains a wide range of visual resources (Section 13.1.7, Land Use, Recreation, and Airspace). The state has over 400 miles of coastline and 35 coastal islands, providing ocean views and scenic, rocky, shoreline vistas (RI.gov, 2015a). The western portion of the state is part of the Appalachian Highlands, with low mountains, deciduous and hardwood forests, rivers, and lakes (RI.gov, 2015a; The Nature Conservancy and the Rhode Island Department of Environmental Management, 2015). There are no major mountain ranges in Rhode Island; the highest point in the state is the 812 foot Jerimoth Hill near the northwestern border of the state. About 60 percent of the state is forested which may impart a more rural feel to the scenery (The Nature Conservancy and the Rhode Island Department of Environmental Management, 2015) (USFS). Eastern and southeastern Rhode Island is Seaboard Lowland of mostly sea-level lands with salt marshes, coastal habitat, lighthouses, beaches, and classic New England style harbor towns (RI.gov, 2015a).

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.

13.1.8.4. 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. Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 13.1.8-1 shows areas that are included in the National Register of Historic Places that may be considered visually sensitive.

In Rhode Island, there are 771 NRHP listed sites, which includes 1 National Heritage Area, 1 National Memorial, 1 National Historical Site, 1 National Historic Trail, and 45 National Historic Landmarks (NPS, 2015c) (NPS, 2015d). Section 13.1.11 provides details on the historic resources in Rhode Island. Some State Historic Sites, State Heritage Areas, and State Historic Districts may also be included in the NRHP, whereas others are not designated at this time.

The National Park Service is required to protect all aspects of historic landscapes considered significant, such as forests, gardens, trails, structures, ponds, and farming areas using *The Secretary of the Interior's Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes* (National Park Service 1995). The standards and guidelines "require retention of the greatest amount of historic fabric, including the landscape's

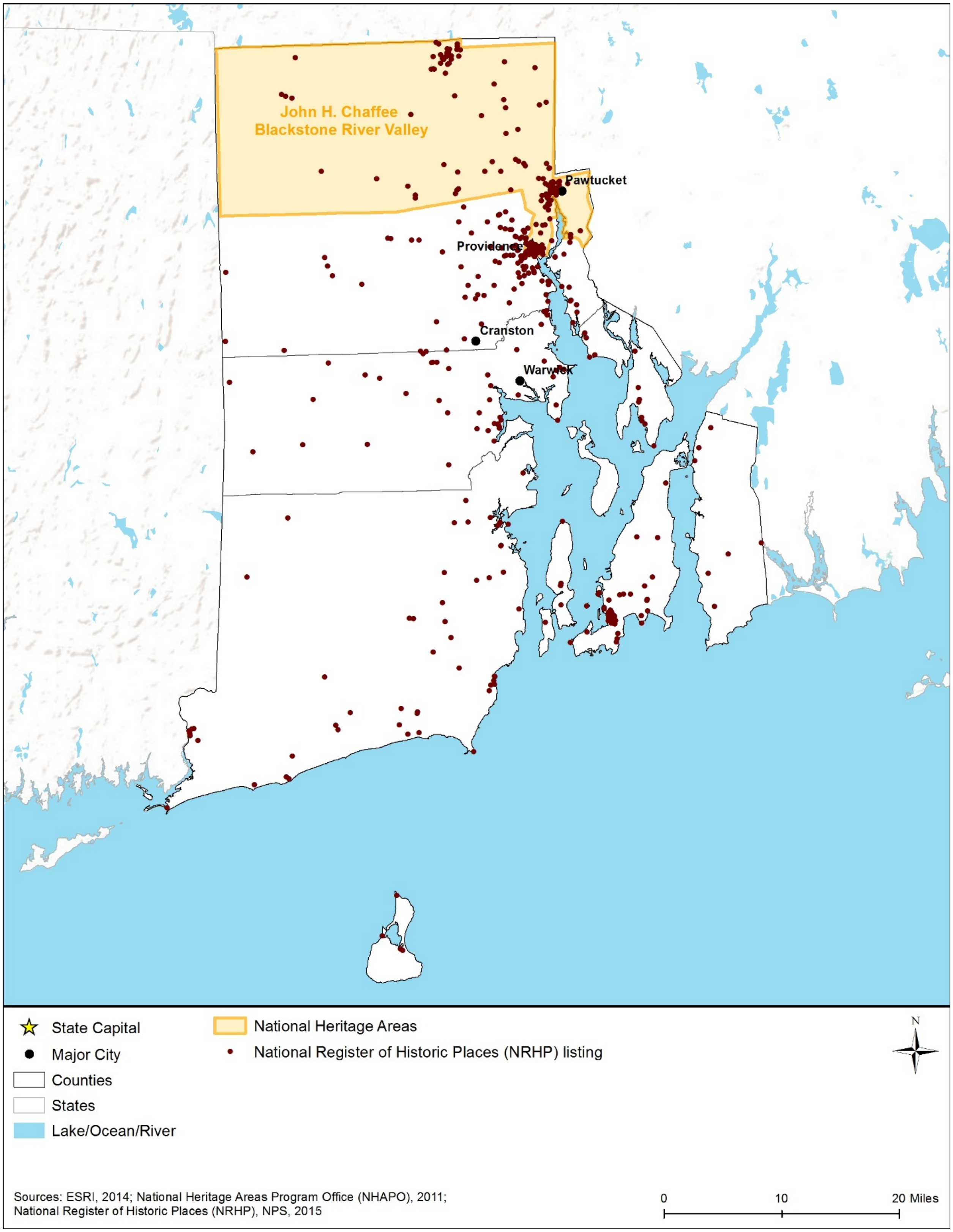

Figure 13.1.8-1: Cultural and Heritage Resources that May Be Visually Sensitive

historic form, features, and details as they have evolved over time," which directly protects the historic properties and the visual resources therein (National Park Service 1995).

National Heritage Area

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. One such area is the Blackstone River Valley National Heritage Corridor, located in Rhode Island and Maryland and covering over 500 square miles. The watershed contains expanses of forests, the Blackstone River, and 24 cities and towns with historic mills and cultural sites. The Blackstone Heritage Corridor is considered an NHA but the land within the heritage corridor is managed and owned by partnerships with various agencies (federal, state, and local); non-profit entities; and private organizations to protect the corridor's historic sites and resources (NPS, 2015e)

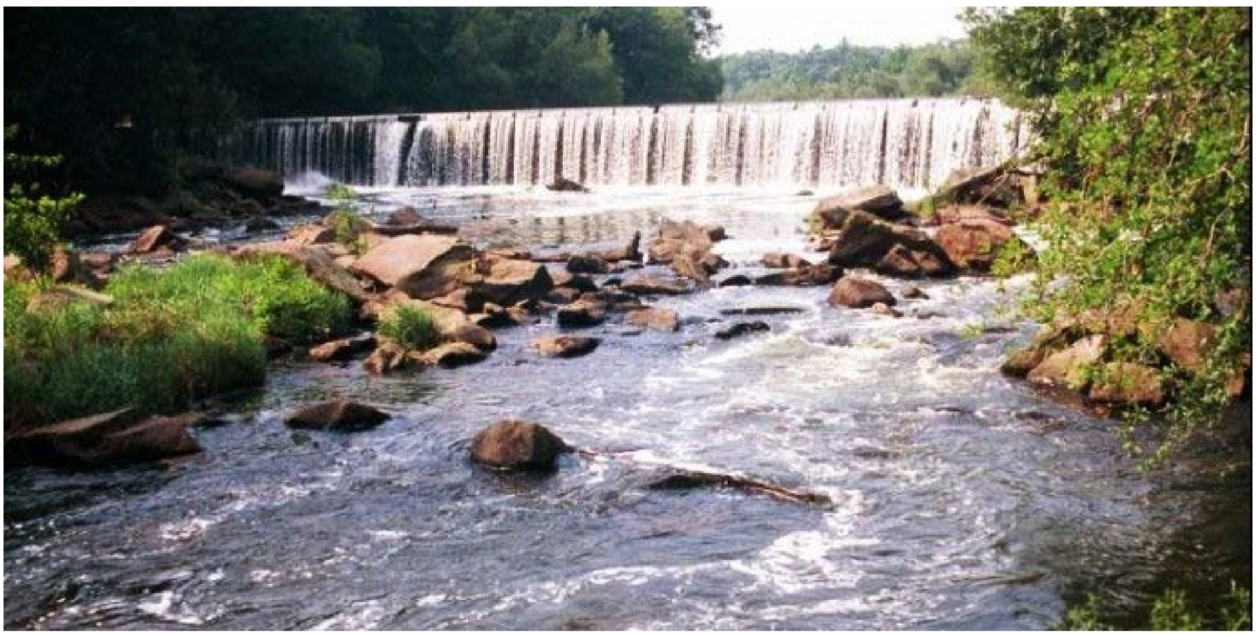

Figure 13.1.8-2: Rolling Dam, Blackstone River Valley National Heritage Corridor

Source: (NPS, 2015e)

National Memorial

Roger Williams National Memorial is 4.5 acres within the town of Providence containing a park and historic buildings. The scenic resources in the area are protected through federal regulations protecting cultural and historic resources along with the National Park Service's visual resource management (NPS, 2015f).

National Historic Site

Touro Synagogue in the town of Newport is the oldest synagogue in the U.S. The site contains the historic building and is managed and protected by the National Park Service (NPS, 2015g).

National Historic Trail

National Scenic and Historic Trails are managed and protected for their cultural, historic, recreational, and scenic values (NPS, 2014b). The Washington-Rochambeau National Historic Trail traverses 10 states, including Rhode Island (NPS, 2015c). The trail follows the historic Revolutionary War route through historic towns, forested areas, natural landscapes, and the Hudson River Valley (NPS, 2015g). These historic trails are often managed as joint ventures of the National Park Service with state or local agencies or non-profit organizations and are protected by the National Park Service's visual resource management program (New England Trail, National Scenic Trail, 2015).

National Historic Landmarks

National Historic Landmarks 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, 2015h). The sites are not owned or managed by the National Park Service, but the properties are covered by state and local historic and cultural resource policies which protect scenic and visual resources (NPS, 2014c). There are about 2,500 National Historic Landmarks in the U.S. and 45 are within Rhode Island (NPS, 2015h) (NPS, 2015i). The landmarks vary from historic homes and buildings, battle sites, churches, archaeological sites, and historic districts within the towns of Newport and Providence (NPS, 2015i).

13.1.8.5. Parks and Recreation Areas

Parks and recreation areas in Rhode Island include state parks, state beaches, and state forests. Parks and recreation areas often contain scenic resources and are often visited because of their visual or aesthetic qualities. Figure 13.1.7-3 in Section 13.1.7, Land Use, Recreation, and Airspace identifies parks and recreational resources in Rhode Island.

State Parks and Beaches

There are 13 state parks and 7 state beaches in Rhode Island (Rhode Island Division of Parks and Recreation, 2015a). Rhode Island state parks encompass a wide range of natural habitats, cultivated urban areas, and historic structures. Burlingame State Park and Campground is a 3,100 acre forested landscape with a pond in the heart of the park (Rhode Island Division of Parks and Recreation, 2015b). Rocky Point State Park near Providence is an urban park that provides scenic ocean and shoreline vistas (Rhode Island Division of Parks and Recreation, 2015c). Figure 13.1.8-3 lists the seven state beaches and their scenic resources within the state. The varied scenic resources of the state parks and beaches are protected by many state policies for the management and protection of visual resources.

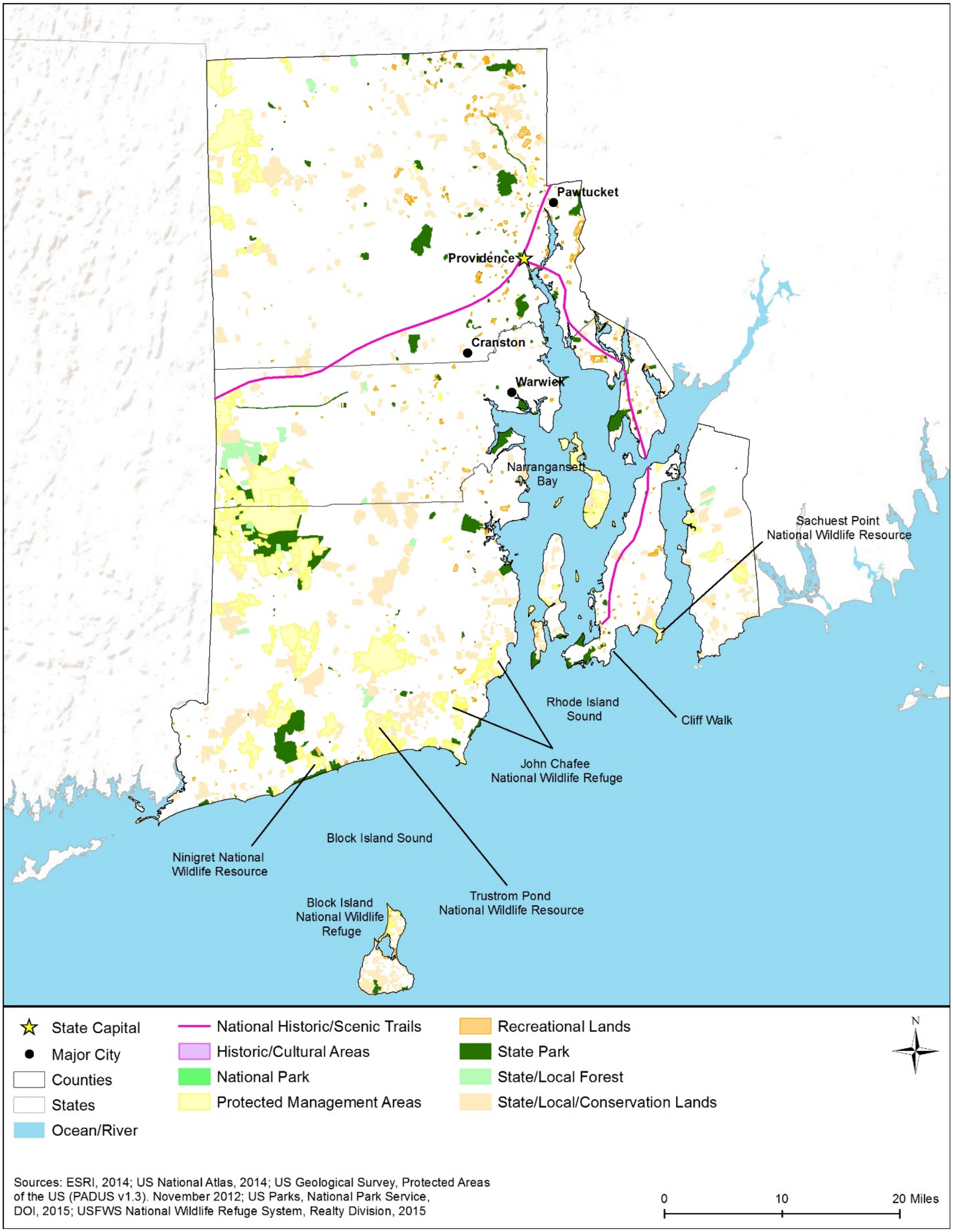

Figure 13.1.8-3: Natural Areas that May Be Visually Sensitive

Table 13.1.8-2: State Beaches

Beach Name	Scenic Resources
Charlestown Breachway	Island, coastal, beach, and ocean views
East Beach	3 miles of beach shoreline and coastal views
East Matunuck State Beach	Beach, ocean, and coastline views
Misquamicut State Beach	0.5 miles of beach, coastline, and ocean views
Roger W. Wheeler State Beach	Beach, ocean, and coastline views
Salty Brine State Beach	Beach, ocean, and coastline views
North and South Scarborough State Beaches	Beach, ocean, and coastline views

Source: (Rhode Island Division of Parks and Recreation, 2015a)

State Forests

There are about 40,000 acres of state-owned forests managed by the Rhode Island Forest Environment Program (RIDEM, 2015p). Arcadia Management Area, managed by the Department of Forest Environment, contains 14,000 acres of forested lands with streams, ponds, and trails that is open to the public for multiple uses. The lands are protected through several state policies which protect the landscape and the visual resources within the area (Rhode Island Division of Parks and Recreation, 2015d). Arcadia Management Areas and other Rhode Island forests are managed for economic resources as well as for recreation use, watershed, and ecosystem health (USFS, 2002). While the forests are not managed specifically for visual resources, the natural resources within the forests are managed for conservation and protected by State Guide Plan Element 161 (Rhode Island Department of Administration, Division of Planning Statewide Planning Program, 2005).

13.1.8.6. Natural Areas

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, 2015w).” There are five NWRs in Rhode Island that are managed as the Rhode Island National Wildlife Refuge Complex (Table 13.1.8-3). The refuges are found along the southern portion of the state and all are located along the coastline except for Block Island which is about 10 miles off the coast in the Atlantic Ocean (USFWS, 2006).

Table 13.1.8-3: National Wildlife Refuges in Rhode Island

Refuge Name	Acres	Scenic Resources
Block Island	127	Island view from shore; shoreline and ocean views
John H. Chafee	554	Marshlands, river views
Ninigret	409	Swamps, grassland, freshwater ponds, and wetlands
Sachuest Point	242	Coastline, rocky shore, salt marsh, and upland shrub
Trustom Pond	787	Beaches, saltwater ponds, wetlands, and upland shrubs

Source: (USFWS, 2006)

National Natural Landmark

National Natural Landmarks (NNLs) are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (NPS, 2014b). These landmarks may be considered visual resources or visually sensitive. Ell Pond is the only National Natural Landmark in Rhode Island (NPS, 2015c). This 102-acre scenic landscape contains unique plant communities, forests, a unique glacially formed pond, and other geologic features (NPS, 2012). The landmark is state and privately owned, protected, and managed; the National Natural Landmark designation identifies the area as "one of the best examples of a biological or geological feature known to be characteristic of a given natural region" (USDOI, 1999).

Figure 13.1.8-4: Ell Pond National Natural Landmark, Washington County

Source: (NPS, 2012)

13.1.8.7. Additional Areas

State Scenic Roadways

Rhode Island does not contain any designated National Scenic Byways, but it does have eight state scenic roadways that were created and managed to protect the historic and scenic values along these roadways. Table 13.1.8-4 lists the scenic roadways and the scenic features found along these roadways (RIDOT, 2015c) (RIDOT, 2015b)

Table 13.1.8-4: State Scenic Byways in Rhode Island

Name	Scenic Features
Minsterial Road	Forests with fall color, unique geologic features, streams, ponds, stone walls, and wetlands
Great Road and Breakneck Hill Road	Historic roadway, farmlands, open spaces, and grand vistas
Route 114	Historic and cultural sites, geological features, forests, coastline, beaches, saltwater ponds
Paradise Avenue Loop	Historic structures, rivers, forests, wetlands, and shorelines
Route 102	Rolling hills with hilltop vistas, open space, forests, valleys, and streams,

Name	Scenic Features
Route 1	Historic homes and sites, tree-lined roadway, harbor views, and parks
Shannock Road	Rolling hills, historic mill, stone walls, farmland, forest, and marshland
Veterans Memorial Parkway	River views, Providence skyline, and wooded areas

Source: (RIDOT, 2015b)

Other State Lands

Dame Farm is about 500 acres of working farmlands with historic buildings, protecting the rural landscape and scenic resources of the farmlands (Rhode Island Division of Parks and Recreation, 2015e). The John H. Chafee Nature Preserve is protected by a conservation easement for the “agricultural, educational and scenic values, and its natural and historical resources” of the lands (Rhode Island Division of Parks and Recreation, 2015f)

13.1.9. Socioeconomics

13.1.9.1. 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. When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of FirstNet projects as those projects may affect the socioeconomic conditions of a region.

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet’s mission is to provide public safety broadband and interoperable emergency communications coverage throughout the nation. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes.

The financial arrangements for deployment and operation of the FirstNet network may have socioeconomic implications. Section 1.1 frames some of the public expenditure and public revenue considerations specific to FirstNet; however this is not intended to be either descriptive or prescriptive of FirstNet’s financial model or anticipated total expenditures and revenues associated with the deployment of the Nationwide Public Safety Broadband Network (NPSBN). This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898 (see Section 1.8). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use and recreation (Section 13.1.7, Land Use, Recreation, and Airspace), infrastructure (Section 13.1.1, Infrastructure), and aesthetic considerations (Section 13.1.8, Visual Resources).

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, 2016).

The remainder of this section addresses the following subjects: regulatory considerations specific to socioeconomics in the state, communities and populations, economic activity, housing, property values, and taxes.

13.1.9.2. 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.

13.1.9.3. Communities and Populations

This section discusses the population and major communities of Rhode Island and includes the following topics:

- Recent and projected statewide population growth
- Current distribution of the population across the state
- Identification of the largest population concentrations in the state

13.1.9.4. Statewide Population and Population Growth

Table 13.1.9-1 presents the 2014 population and population density of Rhode Island in comparison to the East region[90] and the nation. The estimated population of Rhode Island in 2014 was 1,055,173. The population density was 1,021 persons per square mile (sq. mi.), which is higher than the population density of both the region (312 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Rhode Island was the 43rd largest state by population among the 50

[90] The East region includes the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia, as well as the District of Columbia. Throughout the socioeconomics section, figures for the East region represent the sum of the values for all "states" (including the District of Columbia) in the region, or an average for the region based on summing the component parameters. For instance, the population density of the East region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

states and the District of Columbia, second smallest by land area, and had the third greatest population density (U.S. Census Bureau, 2015g; U.S. Census Bureau, 2015f).

Table 13.1.9-1: Land Area, Population, and Population Density of Rhode Island

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Rhode Island	1,034	1,055,173	1,021
East Region	237,157	73,899,862	312
United States	3,531,905	318,857,056	90

Sources: (U.S. Census Bureau, 2015g; U.S. Census Bureau, 2015f)

Population growth is an important subject for this PEIS given FirstNet's mission. Table 13.1.9-2 presents the population growth trends of Rhode Island from 2000 to 2014 in comparison to the East region and the nation. The state's annual growth rate stayed similar in the 2010 to 2014 (0.06 percent) period compared to 2000 to 2010 (0.04 percent). Rhode Island showed significantly lower growth rates in both periods compared to the region's and nation's growth rates (e.g., 0.06 percent for Rhode Island from 2010 to 2014 compared to 0.50 percent for the region and 0.81 percent for the nation).

Table 13.1.9-2: Recent Population Growth of Rhode Island

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
Rhode Island	1,048,319	1,052,567	1,055,173	4,248	2,606	0.04%	0.06%
East Region	69,133,382	72,444,467	73,899,862	3,311,085	1,455,395	0.47%	0.50%
United States	281,421,906	308,745,538	318,857,056	27,323,632	10,111,518	0.93%	0.81%

Sources: (U.S. Census Bureau, 2015h; U.S. Census Bureau, 2015g)

[a] AARC = Average Annual Rate of Change (compound growth rate)

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 13.1.9-3 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. 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 that Rhode Island's population will increase by approximately 72,000 people, or 6.8 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.41 percent, which is several times higher than the historical growth rate from 2010 to 2014 of 0.06 percent. This probably reflects variables in the population projection models that indicate changing conditions in the state. The projected growth rate of the state is less than that of the region (0.57 percent) and the nation (0.80 percent).

Table 13.1.9-3: Projected Population Growth of Rhode Island

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) 2014 to 2030
Rhode Island	1,055,173	1,114,914	1,139,601	1,127,258	72,085	6.8%	0.41%
East Region	73,899,862	78,925,282	82,842,294	80,883,788	6,983,926	9.5%	0.57%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.6%	0.80%

Sources: (U.S. Census Bureau, 2015g; ProximityOne, 2015; UVA Weldon Cooper Center, 2015)
AARC = Average Annual Rate of Change (compound growth rate)

13.1.9.5. Population Distribution and Communities

Figure 13.1.9-1 presents the distribution and relative density of the population of Rhode Island. 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, 2015i).

This map also presents the three 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, 2015j; U.S. Census Bureau, 2015k). 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. The heaviest population concentration by far was in the Rhode Island portion of the Providence area, particularly the area in and around the city of Providence. The western half of the state is less densely populated.

Table 13.1.9-4 provides the populations of the three largest population concentrations in Rhode Island, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses[91]. In 2010, the largest population concentration by far was the Rhode Island portion of the Providence area, which had nearly 950,000 people. The smallest

[91] 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.

of the three population concentration areas was the Charlestown area, with a 2010 population of 2,942. The Rhode Island portion of the Norwich/New London area was also small, with a 2010 population of 21,242.

Table 13.1.9-4 also shows that the top three population concentrations accounted for over 90 percent of the state's population in all time periods shown in the table, and the Rhode Island portion of the Providence area accounted for the vast majority of the population of the three areas. The Providence area had a positive but slight growth rate from 2000 to 2010; all other population concentrations experienced population declines. Together, population growth in the three areas from 2000 to 2010 amounted to 44.7 percent of the entire state's growth.

Table 13.1.9-4: Population of the Three Largest Population Concentrations in Rhode Island

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Charlestown	3,013	2,942	3,103	3	(71)	-0.24%
Norwich/New London (CT/RI) (RI Portion)*	22,014	21,149	21,242	2	(865)	-0.40%
Providence (RI/MA) (RI Portion)	927,003	930,680	930,046	1	3,677	0.04%
Total for Top Three Population Concentrations	952,030	954,771	954,391	NA	1,897	0.02%
Rhode Island	1,048,319	1,052,567	1,051,695	NA	4,248	0.04%
Top Three Total as Percentage of State (Statewide)	90.8%	90.7%	90.7%	NA	44.7%	NA

Sources: (U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015l; U.S. Census Bureau, 2015m)

AARC = Average Annual Rate of Change (compound growth rate)
*Population data for 2000 are for the RI portion of the "Westerly, RI--CT urban cluster." The "Norwich/New London (CT/RI) urbanized area," as delineated by the Census Bureau in 2010, make up the area formerly identified as the "Westerly urban cluster" in 2000.

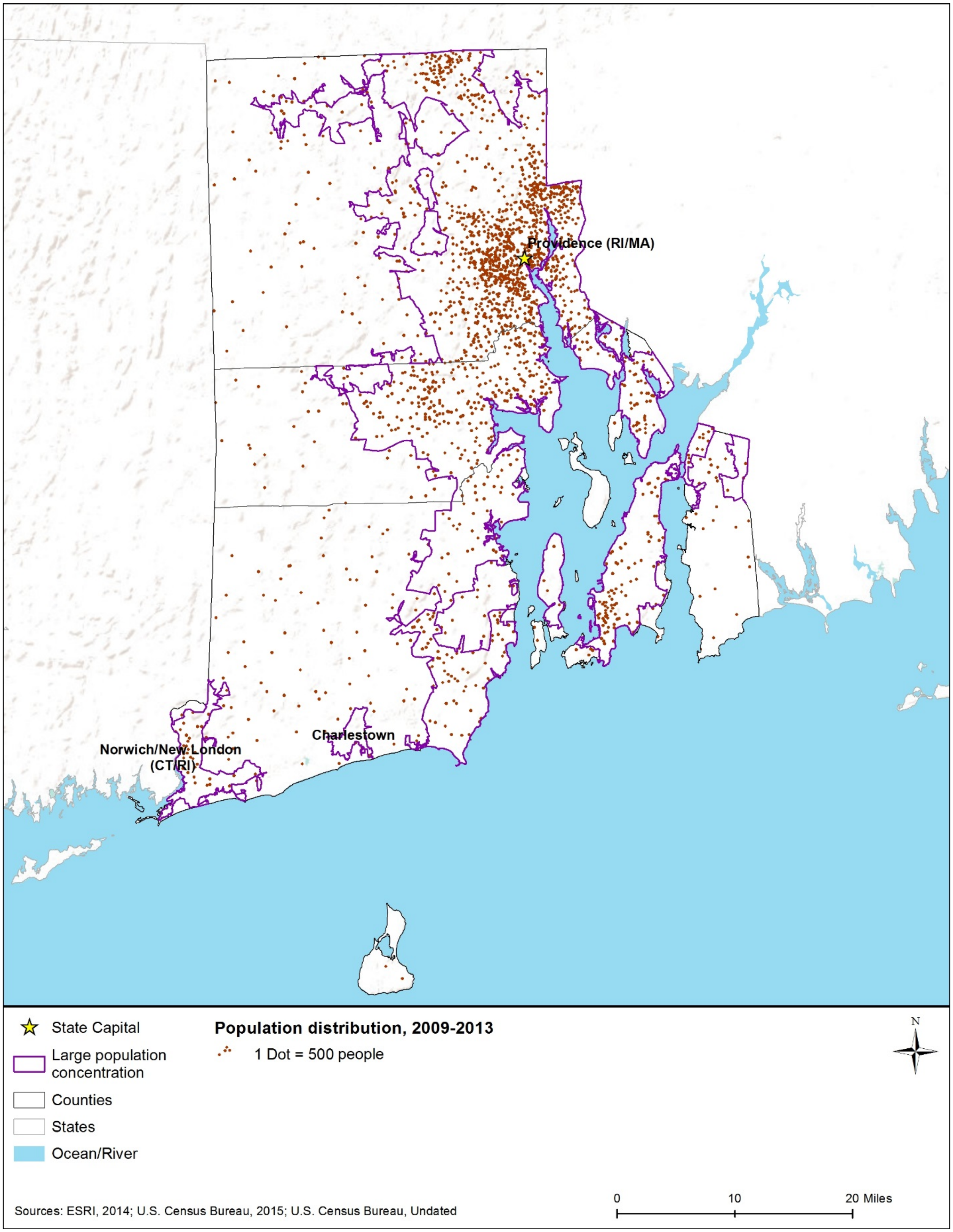

Figure 13.1.9-1: Population Distribution in Rhode Island, 2009–2013

13.1.9.6. 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 13.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 13.1.9-5 compares several economic indicators for Rhode Island to the East region and the nation. The table presents two indicators of income[92] – 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 13.1.9-5, the per capita income in Rhode Island in 2013 ($30,748) was $2,104 lower than that of the region ($32,852), and $2,564 higher 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 13.1.9-5 shows that in 2013, the MHI in Rhode Island ($55,015) was $5,489 lower than that of the region ($60,504), and $2,765 higher 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 13.1.9-5 compares the

[92] 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, 2015n)

unemployment rate in Rhode Island to the East region and the nation. In 2014, Rhode Island's statewide unemployment rate of 7.7 percent was higher than the rate for the region (6.0 percent) and the nation (6.2 percent).[93]

Table 13.1.9-5: Selected Economic Indicators for Rhode Island

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Rhode Island	$30,748	$55,015	7.7%
East Region	$32,852	$60,504	6.0%
United States	$28,184	$52,250	6.2%

Sources: (BLS, 2015b; U.S. Census Bureau, 2015o; U.S. Census Bureau, 2015p; U.S. Census Bureau, 2015q)

Figure 13.1.9-2 and Figure 13.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015o) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 13.1.9-1 (U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k). Following these two maps, Table 13.1.9-6 presents MHI and unemployment for the three 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 Rhode Island.

Figure 13.1.9-2 shows a clear pattern of MHI distribution in Rhode Island. The counties with the highest MHI (above the national average) were located in southern portions of the state. Counties with MHI below the national average were located in the northern portion of the state. Table 13.1.9-6 is consistent with Figure 13.1.9-2. The table shows that the Charlestown and Norwich/New London (Rhode Island portion) areas, which are located in the southernmost portion of the state, had the highest MHI. MHI was lowest in the Rhode Island portion of the Providence area. This area, as defined by the U.S. Census Bureau, spans the east side of the state from south to north, but its population is mostly located in the northern portion of the state, as shown in Figure 13.1.9-1 above.

Figure 13.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that all counties in Rhode Island had unemployment rates above the national average, with highest county unemployment rates in the northern portion of the state. Among the top population concentrations, Table 13.1.9-6 shows that the highest unemployment rate in the 2009–2013 period was in the Charlestown area (11.0 percent).

Detailed employment data provide useful insights into the nature of a local, state, or national economy. Table 13.1.9-7 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

[93] The timeframe for unemployment rates can change quarterly.

worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers was somewhat higher in Rhode Island (82.9 percent) than in the East region (79.3 percent) and the nation (79.7 percent). The percentage of government workers was lower in the state than in the region and nation. Self-employed workers also made up a lower percentage of the workforce in the state compared to the region and nation.

By industry, Rhode Island has a mixed economic base and some notable figures in the table are as follows. In general, most of the industries in the state had comparable employment percentages (mostly within two percentage points) to the region and the nation. One exception was in "manufacturing," which was over two percentage points higher for Rhode Island (10.8 percent) than the region (8.5 percent). For the "professional, scientific, management, administrative, and waste management services" industry, Rhode Island (10.1 percent) had a lower percentage than the region (12.3 percent). Rhode Island had a higher percentage of workers in "educational services, and health care and social assistance" (27.8 percent) than did the region (25.6 percent) or the nation (23.0 percent).

Table 13.1.9-6: Selected Economic Indicators for the Three Largest Population Concentrations in Rhode Island, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Charlestown	$64,821	11.0%
Norwich/New London (CT/RI) (RI Portion)	$60,175	9.8%
Providence (RI/MA) (RI Portion)	$54,005	10.2%
Rhode Island (Statewide)	$56,361	9.9%

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

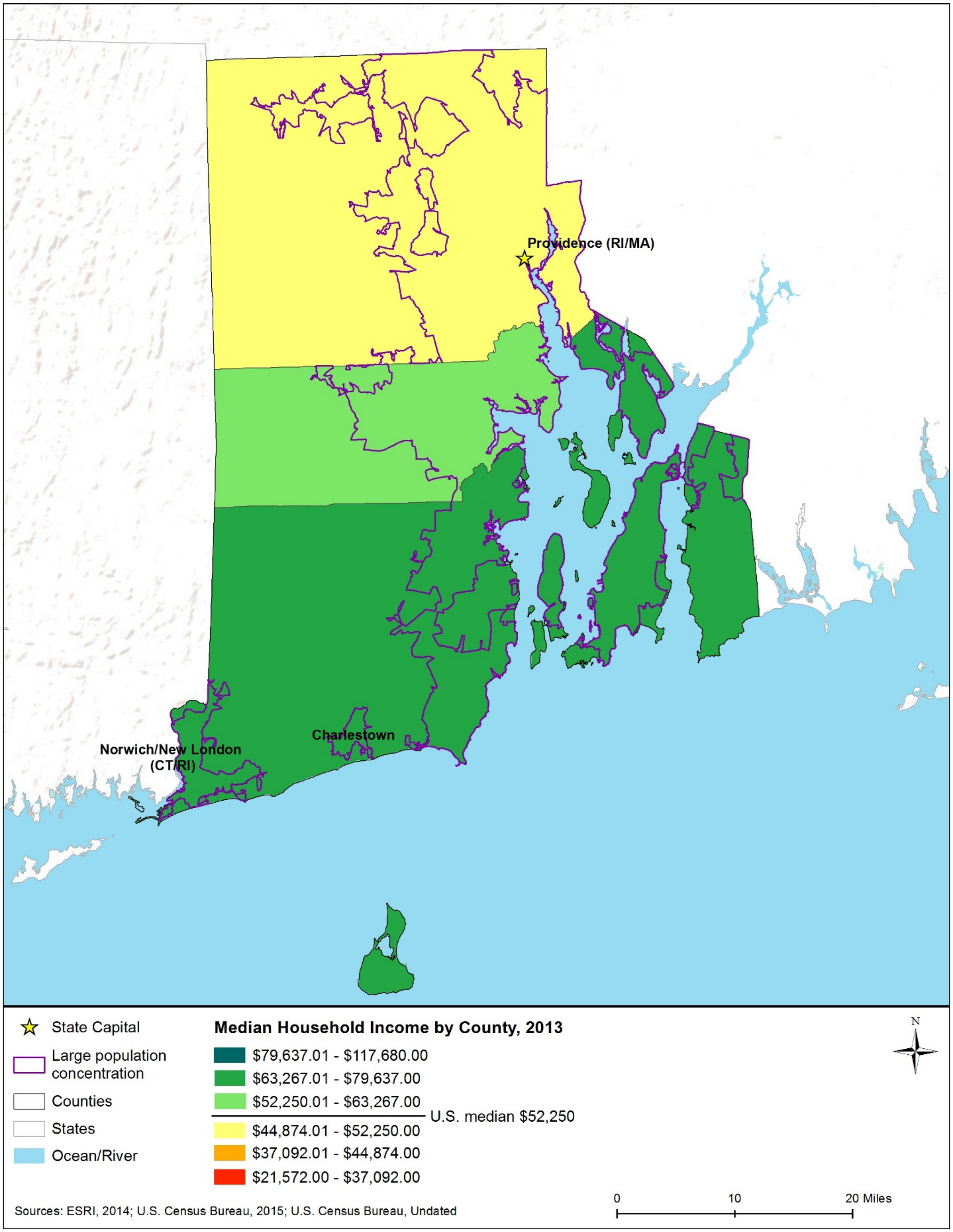

Figure 13.1.9-2: Median Household Income in Rhode Island, by County, 2013

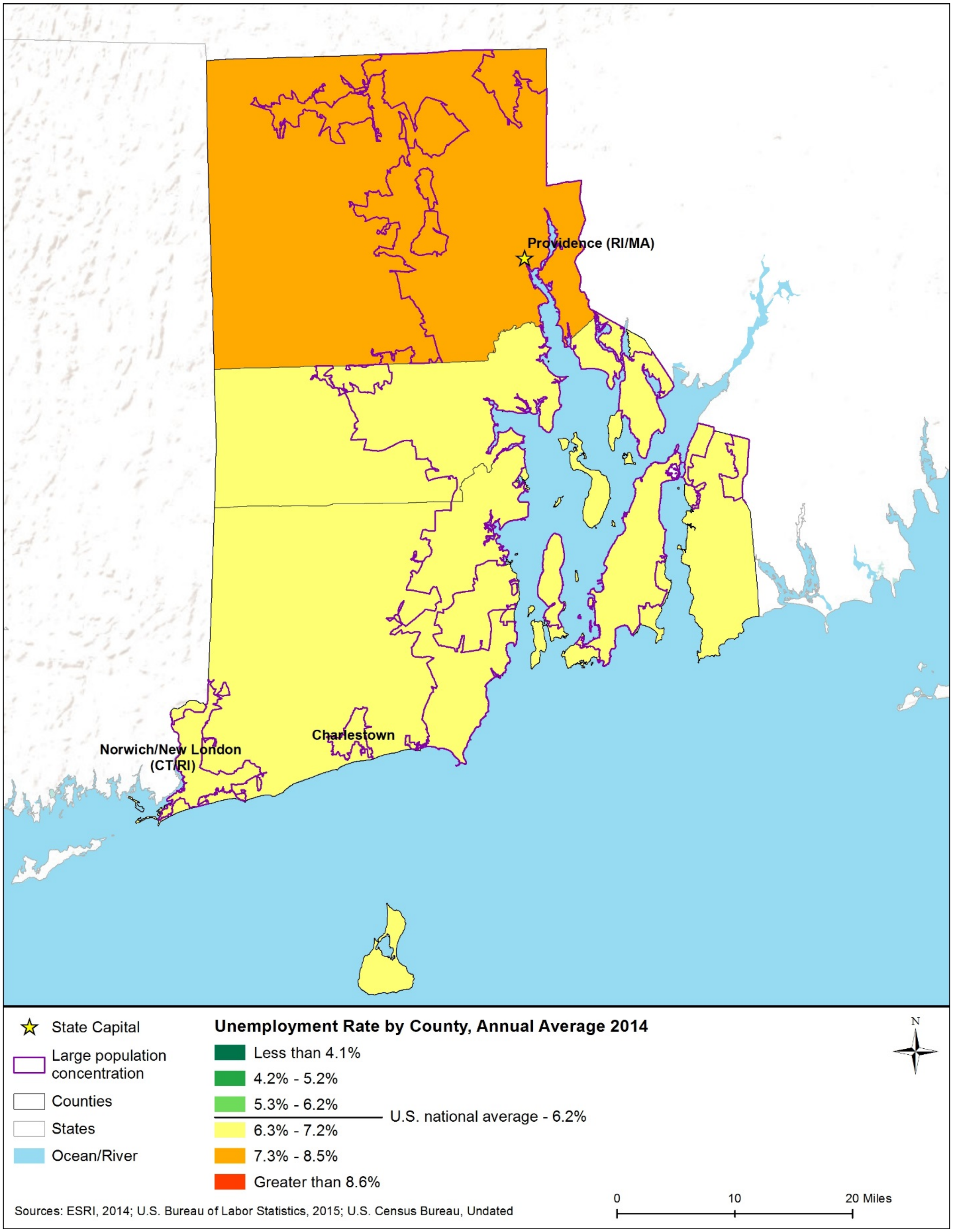

Figure 13.1.9-3: Unemployment Rates in Rhode Island, by County, 2014

Table 13.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Rhode Island	East Region	United States
Civilian Employed Population 16 Years and Over	515,340	35,284,908	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	82.9%	79.3%	79.7%
Government workers	12.1%	15.1%	14.1%
Self-employed in own not incorporated business workers	4.9%	5.4%	6.0%
Unpaid family workers	0.1%	0.1%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	0.3%	0.9%	2.0%
Construction	5.3%	5.8%	6.2%
Manufacturing	10.8%	8.5%	10.5%
Wholesale trade	2.7%	2.5%	2.7%
Retail trade	11.5%	11.1%	11.6%
Transportation and warehousing, and utilities	3.3%	4.6%	4.9%
Information	1.4%	2.3%	2.1%
Finance and insurance, and real estate and rental and leasing	6.6%	7.3%	6.6%
Professional, scientific, management, administrative, and waste management services	10.1%	12.3%	11.1%
Educational services, and health care and social assistance	27.8%	25.6%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	11.3%	8.9%	9.7%
Other services, except public administration	4.7%	4.9%	5.0%
Public administration	4.1%	5.5%	4.7%

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

Table 13.1.9-8 presents employment shares for selected industries for the three 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 13.1.9-7 for 2013.

Table 13.1.9-8: Employment by Selected Industries for the Three Largest Population Concentrations in Rhode Island, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative, and Waste Management Services
Charlestown	17.7%	4.1%	0.0%	8.4%
Norwich/New London (CT/RI) (RI Portion)	6.0%	3.3%	2.4%	7.0%
Providence (RI/MA) (RI Portion)	4.7%	3.6%	1.7%	9.7%
Rhode Island (Statewide)	5.0%	3.6%	1.7%	9.7%

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

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 13.1.9-9 compares Rhode Island to the East region and nation on several common housing indicators.

As shown in Table 13.1.9-9, in 2013 Rhode Island had a similar percentage of housing units that were occupied (88.0 percent) compared to the region (88.4 percent) and nation (87.5 percent). Of the occupied units, Rhode Island had a slightly lower percentage of owner-occupied units (60.4 percent) than the region (62.8 percent) or nation (63.5 percent). The state had a higher percentage of detached single-unit housing (also known as single-family homes) in 2013 (55.8 percent) compared to the region (52.7 percent) but lower than the nation (61.5 percent). The homeowner vacancy rate in Rhode Island (1.9 percent) matched the rate for the nation and was slightly higher than the rate for the region (1.6 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015n). The vacancy rate among rental units was higher in Rhode Island (7.0 percent) than in the region (5.5 percent) or nation (6.5 percent).

Table 13.1.9-9: Selected Housing Indicators for Rhode Island, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Rhode Island	461,658	88.0%	60.4%	1.9%	7.0%	55.8%
East Region	31,108,124	88.4%	62.8%	1.6%	5.5%	52.7%
United States	132,808,137	87.5%	63.5%	1.9%	6.5%	61.5%

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

Table 13.1.9-10 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 13.1.9-10 shows that during this period the percentage of occupied housing units ranged between 50.3 to 89.7 percent across these population concentrations.

Table 13.1.9-10: Selected Housing Indicators for the Three Largest Population Concentrations in Rhode Island, 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
Charlestown	2,710	50.3%	73.3%	6.6%	2.4%	87.0%
Norwich/New London (CT/RI) (RI Portion)	11,080	81.6%	65.8%	1.0%	5.6%	66.8%
Providence (RI/MA) (RI Portion)	405,362	89.7%	58.4%	2.0%	6.9%	51.2%
Rhode Island (Statewide)	462,516	88.7%	61.2%	1.9%	6.8%	55.3%

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

Property Values

Property values have important relationships to both the wealth and affordability of communities.

Table 13.1.9-11 provides indicators of residential property values for Rhode Island and compares these values to values for the East 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, 2015n).

The table shows that the median value of owner-occupied units in Rhode Island in 2013 ($232,300) was lower than the corresponding values for the East region ($249,074) and for the nation ($173,900).

Table 13.1.9-11: Residential Property Values in Rhode Island, 2013

Geography	Median Value of Owner-Occupied Units
Rhode Island	$232,300
East Region	$249,074
United States	$173,900

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

Table 13.1.9-12 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. All areas except the Rhode Island portion of Providence area had a median value higher than the state median value ($247,000). The Charlestown area, which had the highest median household income ($83,875; see Table 13.1.9-6), also had the highest median value of owner-occupied units ($319,300). Similarly, the Rhode Island portion of the Providence area had the lowest median household income and the lowest median value of owner-occupied units ($237,800).

Table 13.1.9-12: Residential Property Values for the Three Largest Population Concentrations in Rhode Island, 2009–2013

Area	Median Value of Owner-Occupied Units
Charlestown	$319,300
Norwich/New London (CT/RI) (RI Portion)*	$282,600
Providence (RI/MA) (RI Portion)	$237,800
Rhode Island (Statewide)	$247,400

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

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[94] are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. These revenue streams are typically highly localized and therefore are best considered in the deployment phase of FirstNet.

Table 13.1.9-13 presents total and selected state and local government revenue sources as reported by the Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures were particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure.

General and selective sales taxes may change, reflecting expenditures during system development and maintenance.

[94] Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services. (U.S. Census Bureau, 2006)

Table 13.1.9-13 shows that the state government in Rhode Island in 2012 received more total revenue on a per capita basis than other state governments in the region and nation, while local governments in Rhode Island received less than their counterparts in the region and nation. The same pattern was true for Rhode Island state and local governments vis-à-vis intergovernmental revenues[95]. The Rhode Island state government obtained very little revenue from property taxes. Local governments in Rhode Island obtained higher levels of property taxes per capita than local governments in the region or nation. General sales taxes were higher on a per capita basis for the Rhode Island state government compared to its counterparts in the region and nation. Selective sales taxes, and public utility taxes specifically, were higher for the Rhode Island state government than other state governments in the region or nation. Individual income tax revenue per capita for the Rhode Island state government was lower compared to the region and higher compared to the nation. Corporate income tax revenue per capita for the Rhode Island state government was lower than for those governments in the region and nation. Rhode Island local governments obtained no revenues from general sales taxes, public utility taxes, and individual and corporate sales taxes. Rhode Island local governments had lower per capita selective sales tax revenue than their counterparts in the region and nation.

[95] Intergovernmental revenues are those revenues received from the federal government or other government entities such as shared taxes, grants, or loans and advances.

Table 13.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		Rhode Island State Govt. Amount	Rhode Island Local Govt. Amount	Region State Govt. Amount	Region Local Govt. Amount	United States State Govt. Amount	United States Local Govt. Amount
Total Revenue	($M)	$7,947	$4,275	$522,354	$431,898	$1,907,027	$1,615,194
	Per capita	$7,566	$4,071	$7,132	$5,897	$6,075	$5,145
Intergovernmental from Federal	($M)	$2,311	$187	$135,435	$20,289	$514,139	$70,360
	Per capita	$2,200	$178	$1,849	$277	$1,638	$224
Intergovernmental from State	($M)	$0	$969	$0	$120,274	$0	$469,147
	Per capita	$0	$923	$0	$1,642	$0	$1,495
Intergovernmental from Local	($M)	$35	$0	$9,810	$0	$19,518	$0
	Per capita	$33	$0	$134	$0	$62	$0
Property Taxes	($M)	$2	$2,344	$2,215	$144,319	$13,111	$432,989
	Per capita	$2	$2,232	$30	$1,971	$42	$1,379
General Sales Taxes	($M)	$842	$0	$49,123	$15,874	$245,446	$69,350
	Per capita	$802	$0	$671	$217	$782	$221
Selective Sales Taxes	($M)	$636	$25	$38,070	$5,996	$133,098	$28,553
	Per capita	$605	$24	$520	$82	$424	$91
Public Utilities Taxes	($M)	$103	$0	$4,314	$2,261	$14,564	$14,105
	Per capita	$98	$0	$59	$31	$46	$45
Individual Income Taxes	($M)	$1,081	$0	$102,813	$18,838	$280,693	$26,642
	Per capita	$1,029	$0	$1,404	$257	$894	$85
Corporate Income Taxes	($M)	$123	$0	$14,112	$6,733	$41,821	$7,210
	Per capita	$117	$0	$193	$92	$133	$23

Sources: (U.S. Census Bureau, 2015v; U.S. Census Bureau, 2015w)

Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006).
Note: This table does not include all sources of government revenue. Summation of the specific source rows does not equal total revenue.

13.1.10. Environmental Justice

13.1.10.1. 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. The fundamental principle of environmental justice as stated in the EO 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”

(Executive Office of the President, 1994). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (USDOC, 2013b).

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, 2015g) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015h).

The CEQ guidance provides several important definitions and clarifications that this PEIS utilizes:

- Minority populations consist of "Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic."
- Low-income populations consist of individuals living in poverty, as defined by the U.S. Census Bureau (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).

13.1.10.2. Specific Regulatory Considerations

The Rhode Island Industrial Property Remediation and Reuse Act (IPRARA), enacted in 1995, regulates cleanup, remediation, and redevelopment of contaminated sites and serves as the basis for the state's environmental justice program.

Table 13.1.10-1: Relevant Rhode Island Environmental Justice Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Industrial Property Remediation and Reuse Act (IPRARA)	RIDEM	Requires RI DEM to ensure that "the effects that clean-ups would have on the populations surrounding each site and shall consider the issues of environmental equity for low income and racial minority populations."

Source: (State of Rhode Island, 2015c)

13.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 13.1.10-2 presents 2013 data on the composition of Rhode Island's population by race and by Hispanic origin. Only populations identifying as White (80.5 percent) and Some Other Race (6.9 percent) have higher percentages than the populations of the East region and the nation (those percentages are, for White, 72.1 percent for the East region and 73.7 percent for the nation; for Some Other Race, 4.8 percent for the East region and 4.7 percent for the nation). The state's percentages of persons identifying as Black/African American (6.4 percent), Asian (3.2 percent), and Two or More Races (2.6 percent) are lower than those of the East region or the nation.

The state's population of persons identifying as Hispanic (13.6 percent) is lower than that of the nation and higher than that of the East region. 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. Rhode Island's All Minorities population percentage (25.4 percent) is considerably lower than that of the East region (34.0 percent) or the nation (37.6 percent).

Table 13.1.10-3 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for Rhode Island (14.3 percent) is slightly higher than that for the East region (13.3 percent) and the figure for the nation (15.8 percent).

Table 13.1.10-2: Population by Race and Hispanic Status, 2013

Geography	Total Population (estimated)	Race							Hispanic	All Minorities[a]
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
Rhode Island	1,051,511	80.5%	6.4%	0.4%	3.2%	0.1%	6.9%	2.6%	13.6%	25.4%
East Region	73,558,794	72.1%	14.4%	0.3%	5.8%	0.0%	4.8%	2.7%	12.2%	34.0%
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, 2015x)

[a] "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 13.1.10-3: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Rhode Island	14.3%
East Region	13.3%
United States	15.8%

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

13.1.10.4. 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 levels; block groups are the smallest geographic units for which regularly updated socioeconomic data are readily available at the time of writing.

Figure 13.1.10-1 visually portrays the results of the environmental justice population screening analysis for Rhode Island. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015z; U.S. Census Bureau, 2015aa; U.S. Census Bureau, 2015bb) and Census

Bureau urban classification data (U.S. Census Bureau, 2015k) (U.S. Census Bureau, 2015j). Figure 13.1.10-1 shows that Rhode Island has a concentrated area with high potential for environmental justice populations in the central Providence area. Additional high potential areas occur in other portions of the state, but almost all are within the densely populated area (large population concentration) associated with Providence, from north to south in the eastern half of the state. Areas with moderate potential for environmental justice populations are more evenly distributed across the state.

It is important to understand how the data behind Figure 13.1.10-1. 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 13.1.10-1 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 NEPA criteria), and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (CEQ, 1997). Section 13.2.10 addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

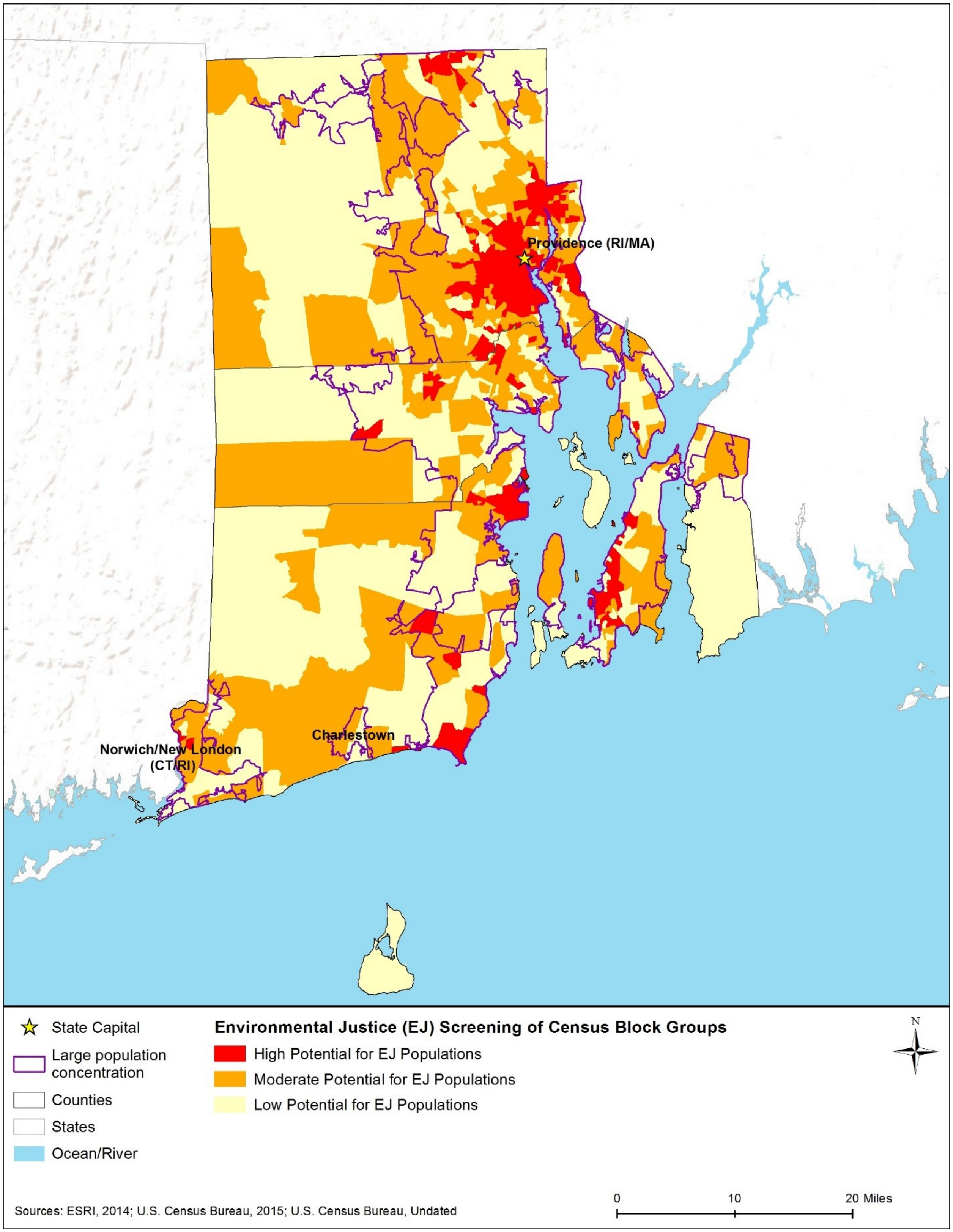

Figure 13.1.10-1: Potential for Environmental Justice Populations in Rhode Island, 2009–2013

13.1.11. Cultural Resources

13.1.11.1. 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 (NPS, 2015j); 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).

13.1.11.2. 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, such as the NHPA (detailed in Section 1.8), the American Indian Religious Freedom Act, ARPA, and NAGPRA. Appendix C summarizes these pertinent federal laws.

Rhode Island has a state law that parallels the NHPA (refer to Table 13.1.11-1). However, federal laws and regulations supersede this law. While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations.

Table 13.1.11-1: Relevant Rhode Island Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
State Register and Undertaking Review Authority, General Laws of Rhode Island, 42-45-5 (a) and (b)	Rhode Island Historical Preservation Commission (SHPO)	This law gives the Rhode Island State Historic Preservation Office (SHPO) the authority to review and comment on state and local government actions that might impact anything that is listed in the state historic register.

13.1.11.3. Cultural Setting

People have been living in the Rhode Island for thousands of years. Based on geological and archaeological evidence, the geographic area that encompasses the state has been inhabited by humans for at least 12,000 years (Custer, J., 1984; Anderson, D., 2001). The majority of the evidence comes from the study of archeological sites that provide important information about the state's pre-European contact and historic populations, and document various cultures, traditions, and human interactions with the environment. In many cases, archeological data are the only information available about the state's early peoples and places.

Archeological sites within the state are found in a wide variety of settings, from forests and flood plains to waterways and hilltops. Prehistoric archeological sites range from temporary fishing encampments to large permanent villages (Moeller, R., 1980). There are also many "resource procurement sites" or areas where the activity appears to have consisted of a single action lasting for perhaps just a few hours, such as hunting sites that typically identify where animals were killed and butchered or well-established waterfront locations where groups of people gathered for a limited time on a regular basis to catch and prepare fish. Most archeological sites are found in relatively shallow deposits, within one to two feet of the surface. However, in some cases, natural factors have caused sites to be buried beneath multiple layers of sediment, such as the deeply stratified floodplain deposits often found along streams and rivers. These deposits can be anywhere from one foot to more than ten feet below the current surface. These sites are typically stratified in layers, with older sites lying in the deepest sediments and more recent deposits being closer to the surface. Areas in which there has been previous disturbances to the ground, such as in densely populated urban settings, such as Providence, may contain archaeological resources within the deeper soils (Wissler, C., 1947).

Archaeologists typically divide large study areas into regions, based on the environment that early humans may have thrived in (Figure 13.1.11-1). Rhode Island is divided into physiographic regions, provinces, and sections. The physiographic sections of the state consist of the New England Upland, Seaboard Lowland and the Embayed area off the southern coast. The physiographic provinces consist of the Coastal Plains within the Embayed section of the state and the New England province. The regions are divided into the Appalachian Highland and Atlantic Plain. By understanding the topography, archaeologists are able to discern what types of sites may be present based on previous research.

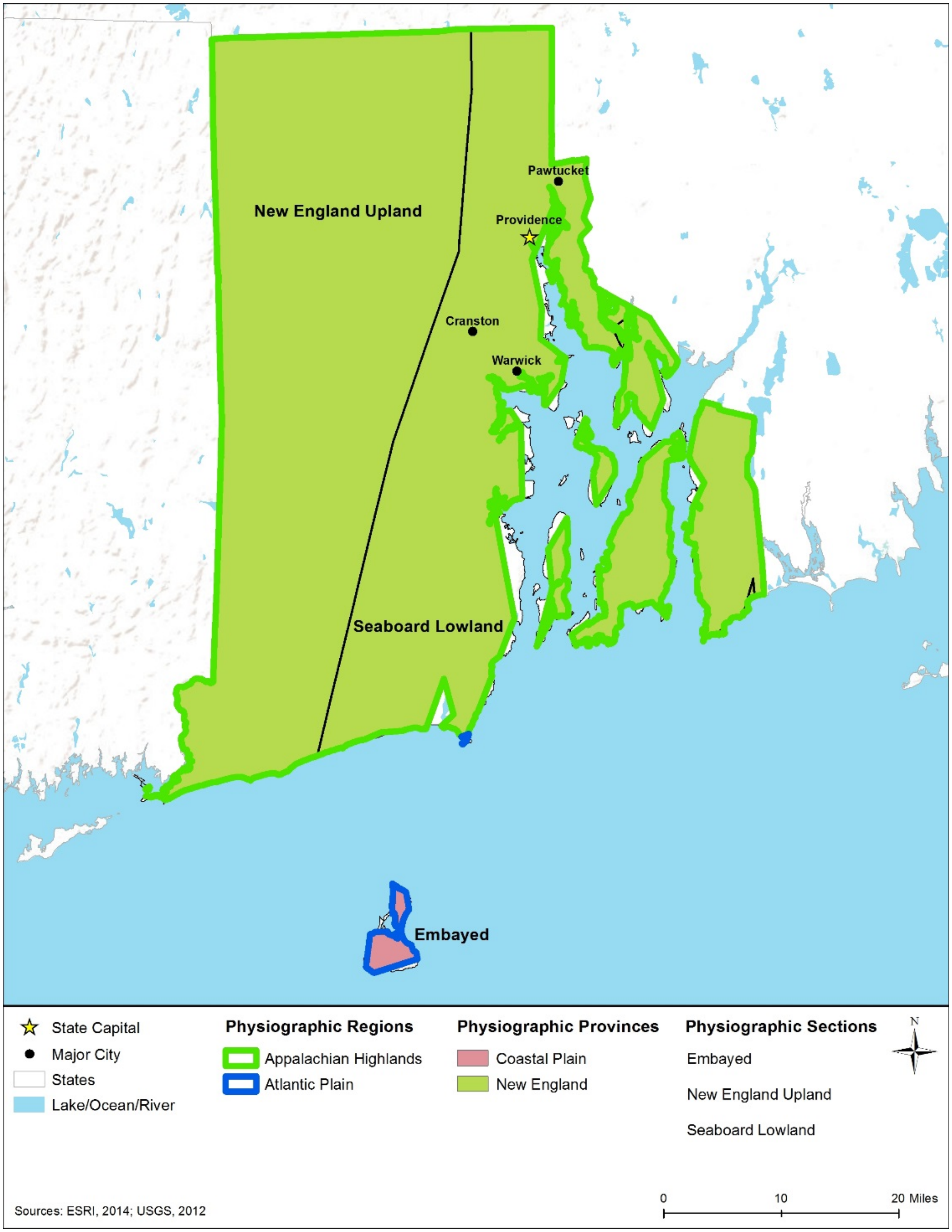

Figure 13.1.11-1: Physiographic Map of Rhode Island

The following material provides additional detail about Rhode Island's prehistoric periods and the historic period since European colonization in the 1600s. Section 13.1.11.4 presents an overview of the initial human habitation in Rhode Island and the cultural development that took place prior to European contact. Section 13.1.11.5 discusses the federally recognized American Indian Tribes with a cultural affiliation to the state. Section 13.1.11.6 provides a current list of significant archaeological sites in Rhode Island and tools that the state has developed to ensure their preservation. Section 13.1.11.7 summarizes the historic context of the state since European contact, and Section 13.1.11.8 addresses the architectural context of the state during the historic period.

13.1.11.4. Prehistoric Setting

There are three distinct periods associated with the prehistoric human populations that inhabited Rhode Island and the greater northeast geography of North America: The Paleoindian period (12,000 to 10,000 B.C.); Archaic (10,000 to 3,000 B.C.); and Woodland (3,000 B.C. to A.D. 1600). Figure 13.1.11-2 shows a timeline representing the periods of the evolving culture in this region. During early archaeological research, there was often no clear distinction between prehistoric periods in the archaeological record, due to overlaps between phases of cultural development (Ritchie, W. A., 1969). Due to advancements in radiocarbon dating techniques, dates of each period in the archaeological record have been increasingly more accurate, and there is no longer much overlap in the timeline of human occupation in North America (Pauketat, T., 2012). Radiocarbon dating techniques and associating artifacts discovered with similar ones previously assigned to a particular range of the archaeological record continue to become increasingly accurate (Pauketat, T., 2012; Haynes, Donahue, Jull, & Zabel, 1984; Haynes et al, 1999).

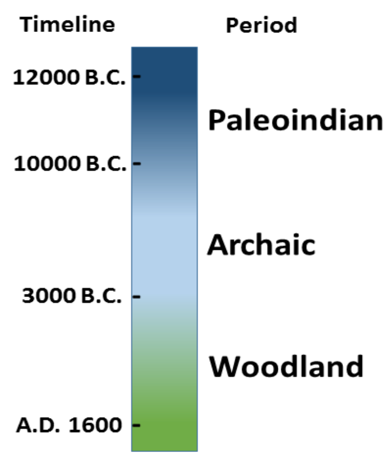

Figure 13.1.11-2: Timeline of Prehistoric Human Occupation

Sources: (Institute of Maritime History, 2015; Pauketat, T., 2012)

The Paleoindian Period (Stone-Age culture) represents the earliest human inhabitants of Rhode Island and the Northeast region of the United States. Much research was conducted throughout the 1980s concentrating on Paleoindian occupation within this region of North America (Rainey, M., 2005). Evidence of early man in Rhode Island is based on a variety of sources such as published site reports, and technical reports that have been prepared for various state agencies. There are also a great number of unpublished documents that archaeologists can use to help better understand the people who lived during this time. The discovery of scatters of fluted points, prehistoric campsites, and other more prominent sites throughout the state allow archaeologists to help understand and protect important sites that may exist. Published literature representing the early stages of the Paleoindian Period suggest that the inhabitants were few in numbers and their way of life is difficult to interpret and understand (Anderson, D., 2001).

It is still unclear as to when these people began to inhabit the region, but there have been several sites identified that have been radiocarbon dated to about 13,000 years ago (Anderson, D., 2001). Based on the evidence, it is likely that they were a highly nomadic and sparsely populated group of people. These nomadic hunters and gatherers used a small inventory of chipped-stone tools known as "fluted javelin head" spear points or Clovis form spear points (fluted points). They probably formed small bands, which ranged freely and far, following migratory game throughout the region. The archaeological record indicates that there were seasonal camps that they returned to, which may have formed the basis for more permanent settlements within the region. No skeletal remains of these people have been identified to date in the state. This group of hunters and gatherers were related to a population of inhabitants that spread into North America via a land bridge at the Bering Strait during the latter part of the Wisconsin glacial age of the Late Pleistocene epoch. (USGS, 2012f).

During the Archaic period in Rhode Island and the greater northeastern portion of North America, people lived in small family based units, commonly referred to as bands. Temperatures were becoming warmer during this period because of the retreating glacial ice sheets, allowing for the plants and animals that inhabit this region today to begin to establish themselves. Much like the Paleoindian peoples that preceded them, Archaic Period people were hunter-gathers whose diet consisted of wild plants and animals. They gathered wild vegetable foods, hunted for game, and became very adept in fishing practices. Archaic Period peoples began building basic shelters and expanded on their ability to make stone weapons and stone tools. However, the culture lacked pottery, the smoking pipe, and technology associated with agriculture (Bolton, 1971; Ritchie, W. A., 1980; Wissler, C., 1947).

The Archaic period has been subdivided into these stages for reasons of environmental changes, expanding food resources resulting in increasing populations, and the continuing development of different sociocultural traditions resulting from contact with other groups through travel or trade (Bolton, 1971; Ritchie, W. A., 1980; Wissler, C., 1947).

Relatively large populations of people inhabited the region of Rhode Island at the beginning of the Archaic Period. The forests of trees that thrived in cold climates, such as spruce, pine, and hemlock, had been largely replaced by deciduous trees, such as oak, chestnut, and maple, which had gradually spread northward from the south as the climate warmed.

The people were beginning to form small bands (groups of about 25-50 people related by kinship and family ties), which who were able to exploit the resources that were becoming increasingly abundant as the climate continued to warm. Early Archaic people made a variety of tools, such as scrapers, cutting instruments, and piercing tools, which allowed them to process animal and plant resources for consumption and use. Wild plants and animals composed the primary diet, however, people were becoming familiar with their environment, and some plants were cultivated and harvested in abundance. As food became more abundant and populations continued to grow, the range in which the people roamed began to decrease. First settlements were along rivers and tributaries. During fall months, multiple bands of people would congregate for the purpose of trading and marriage (Anderson, D., 2001).

Archaeological evidence suggest that by the Middle Archaic Period, the climate of Rhode Island had changed significantly to support a large expanses of mixed deciduous forests, rich in oak and other plant communities. Ecological conditions were much like those that exist today, with minor floral and faunal variations. The region was teaming with wild game, fowl, edible nuts, berries, tubers, roots, and various herbs, all of which would have supported larger populations of semi-nomadic peoples. According to archaeologists, the Middle Archaic Period was a time of dramatic change in the region. The freshwater systems throughout the region supported settlement, rudimentary agriculture, and travel and trade among family bands. The culture began developing instruments such as choppers, narrow-bladed projectile points, beveled adzes, cobbled hammerstones, and other small tools. The inhabitants had not developed very sophisticated food storage techniques during this period, so this may have resulted in an abundance of food during the warmer months and shortages of food during the colder months. This may have allowed for a cultural shift to a more sedentary lifestyle during times of abundance and required more nomadic lifestyle during the leaner winter months. Based on the tool assemblages found, it can be inferred that the people of this period were conducting a number of different daily activities, such as the processing of game, plants, and fish.

In 1980, William Turnbaugh began documenting Early and Middle Archaic sites within the Rhode Island’s Pawcatuck River drainage and along Narragansett Bay. Soon thereafter, the Rhode Island Historic Preservation and Heritage Commission (RIHPHC) developed a historic preservation plan, which identified the physiographic context of Rhode Inland's New England Upland and Seaboard Lowland sections that contain sites identified by Turnburgh. Since the mid-1980s, RIHPHC has inventoried over 1,300 prehistoric sites within the boundaries of Rhode Island, and 33 of them are from the Middle Archaic time (Rainey, M., 2005; Rhode Island Historical Preservation and Heritage Commission, 2015a).

Stone tools typically associated with this period in Rhode Island and the upper east coast of the United States include quartz scrapers, flakes, knives, drills, plummets, hammerstones, drills, whetstones, grooved axes, and other tools. Lithic workshops for manufacturing such tools are found throughout the state. Features such as stone hearths for cooking have also been discovered within this region (Kerber, J., 1997; Leveillee, 2002; Rainey, M., 2005).

The Three Dog Site, Woonasquatucket River Site, and the Ministerial Road Site are archaeological sites that represent the Late Archaic period in Rhode Island (Rhode Island

Historical Preservation and Heritage Commission, 2015a; Jordan et al., 1989; Kerber, J., 1997). Other archaeological sites of this period have been documented throughout Rhode Island and the northeastern part of North America.

Much like most of the northeast during this time, seasonal exploitation of the flora (plants) and fauna (animals) were becoming the predominant way of life. The forests of oak, alder, birch, pine, hemlock, beech, hickory, and chestnut provided edible nuts, wild vegetables, and habitat for game. Adjacent waterways provided fish and shellfish. The warmer climate, and increasing abundance and variety of food sources gave rise to population increases, through new migration of extant groups within the region, an increase of indigenous populations, or both. Large Late Archaic period base camps and settlements have been discovered along major Rhode Island rivers. These camps and settlements likely facilitated the exchange of ideas and information, and allowed for the development of a more sophisticated social life, including the marrying of partners (Kerber, J., 1997).

The cultural activities associated with these sites included the use of a more advanced tool assemblage. Projectile points, scrapers, adzes, gouges, axes, drills, blades, weights, pendants, pestles, and atlatl weights for spear throwing are well documented at these sites. Flint artifacts in the archaeological record indicate trading with people from distant locations as these stone types are not found in Rhode Island. As food became scarce at these sites, people began to disperse into smaller groups of extended families. The resources for exploitation were more scattered and far less abundant, and this situation favored smaller groups that are more mobile. Smaller archaeological sites associated with these smaller bands of people are scattered throughout the state.

By the Terminal Archaic Period, people in Rhode Island had relatively sedentary lifestyle based on a subsistence economy similar to earlier periods. Soapstone cooking vessels begin to appear in the archeological record, indicating that the people were spending more time at permanent camps sites within their respective region or territory. Some cooking vessels weighed as much as 50 pounds, which did not make for easy transport from site to site. The development of soapstone vessels was an Iroquois technology that spread throughout the northeast, including into Rhode Island. The stone was quarried from mines in northwestern Connecticut, and the tools used to produce them and unfinished bowls still attached to the outcrops have been found at these quarry sites. The presence of the soapstone vessels in Rhode Island is evidence of trading and migration by Archaic Period groups from different geographic areas (Kerber, J., 2012).

Based on the evidence of new tool making techniques and the flint materials associated with them, populations began to increase in this region, and this was likely to be the result of people migrating from other regions of the continent. The materials that were used to make many of the tools that have been found during this time were brought from outside of the state (Kerber, J., 2012).

Similar to the Archaic Period, the Woodland Period is divided into three sequential sub-periods: Early, Middle, and Late. The three sub-periods are defined based on various cultural differences that can be distinguished by their temporal (place in time) location and adaptive details that come from close scientific examination. For a long time, archaeologists had a difficulty understanding this period of human development for the region around Rhode Island. By 2006, there were sufficient data to characterize how Woodland Period American Indians lived and their social structure. The period is generally identified by home-building in geographically dispersed villages (Narragansett/Niantic semi-permanent settlement types). In the Early Woodland Period, people continued to develop means to exploit the abundant flora and fauna of the region. By the late Woodland period, they were cultivating plants such a maize and beans. The main technology that differentiates the Woodland Period from previous periods is the development of the first significant use of pottery. (Leveillee et al., 2006).

During the Early Woodland Period, the interior lakes and streams of modern day Rhode Island drained through the salt marshes and lagoons along the coast of the state. The region was teaming with wildlife during this time. The glacial ice sheets had melted enough the leave the area with climate that could support an enormous amount of different food sources and other natural resources. Tool technology continued to advance. The development of new tools is a good indicator that the people were developing a semi-sedentary lifestyle, and living in small villages (Leveillee et al., 2006).

The Middle Woodland Period is distinguished from the Archaic Period by the development of pottery. The influence of migrations from the southern regions of North America are also prevalent in the archaeological record. Artifacts such as the elbow pipe, and the platform pipe, which are part of the Hopewellian mound-building complex (and are associated with the practice of mortuary ceremonialism), begin to appear in the archaeological record (Ritchie, W. A., 1980).

The Middle Woodland Phase is generally associated with a variety of plain and decorated ceramic types as well as numerous lithic and bone tool types. Shellfishing became more important economic pursuit along Rhode Island coast, while rudimentary horticulture began to make a significant contribution to the diet of the local populations. The wide range of burial practices, the use of exotic materials as grave goods, and the presence of artifact types, which are typically associated with sedentary patterns of existence, represent a transition to a drastically different form of livelihood for the peoples of this region (Anderson, D., 2001; The Narragansett Society, 2015).

The archaeological record reveals a continuing change of lifestyle for the people in Rhode Island during the Late Woodland Period. The inhabitants of this time were able to exploit a variety of resources due to their ability to establish organized seasonal settlements. Wild and domesticated plants and animals provided the subsistence they needed for survival. Pottery of traditional classic Woodland lineage continued to undergo progressive modifications. This period is denoted distinctively by an increased dependence on horticulture, especially as it relates to the introduction of corn, maize, and beans by the Narragansett/Eastern Niantic during the late Woodland period. The people of this time lived in large permanent, dispersed central villages, and used seasonal hunting and gathering camps on a temporary basis (Leveillee et al., 2006).

Through the investigations of archaeological sites in a 72-acre parcel in Narragansett, RI, archaeologists have found maize kernels, human burial clusters, storage pits hearths and fire pits, post mounds (for shelters), and pottery (bowls) attributable to the Late Woodland period. Tools such as scrapers, projectile points, chipping debris, pestle, hoes, ground stone artifacts, bone tools, and steatite bowl sherds (Leveillee et al., 2006).

13.1.11.5. Federally Recognized Tribes of Rhode Island

According to the Bureau of Indian Affairs and the National Council of State Legislators, the Narragansett Indian Tribe of Rhode Island is the only federally recognized Tribe in Rhode Island (Figure 13.1.11-3). The Niantic and the Wampanoag Tribe of Rhode Island are not federally recognized tribes (National Conference of State Legislatures, 2010; USDOI, Indian Affairs, 2015).

Rhode Island Cultural Resources Tools and Databases

Rhode Island Historic Preservation & Heritage Commission (RIHPC)

The RIHPHC is the state agency for historical preservation and heritage programs, including the identification and preservation of archaeological resources. The RIHPHC website hosts a number of resources for conducting further research on the pre-history of the state. Services and information that is available are State Historic Preservation Office (SHPO) contact information, how to protect historic properties, information on tax incentives for preserving historic sites and buildings, information on cemeteries, information on the discovery of human remains, a historic property research center, a link to the National Register of Historical Places website, a preservation help center, guidelines on conducting archaeological and historical surveys in Rhode Island, and information on preservation planning (Rhode Island Historical Preservation and Heritage Commission, 2015a). Information directly related to the archaeology of Rhode Island can be found on the Archaeology tab of the RIHPHC website (http://www.preservation.ri.gov/archaeology/). An overview of the states archaeology program and links to field notes, underwater archaeology, cemetery resources, and bibliography of American Indians. Other resources include links to valuable sources such as advocacy groups, archaeological groups and associations, and technical information on historic preservation.

The Narragansett Society – The Rhode Island Chapter of the Archaeological Institute of America

The Narragansett Society is affiliated with the Archaeological Institute of America (AIA). The goal of the Archaeological Institute of America is "expand archaeological knowledge and appreciation of the ancient world through a wide variety of lectures and events open to the public" (RIDEM, 2015p). The Rhode Island chapter of the AIA founded in 1908 and was named the Narragansett Society in the 1980s.

The Narragansett Society website hosts a number of resources that researchers can access for a greater understanding of the archaeological and cultural resources found in Rhode Island. National resources include: the AIA; Society for American Archaeology; American Anthropological Association; American Classical League; and the American Philological

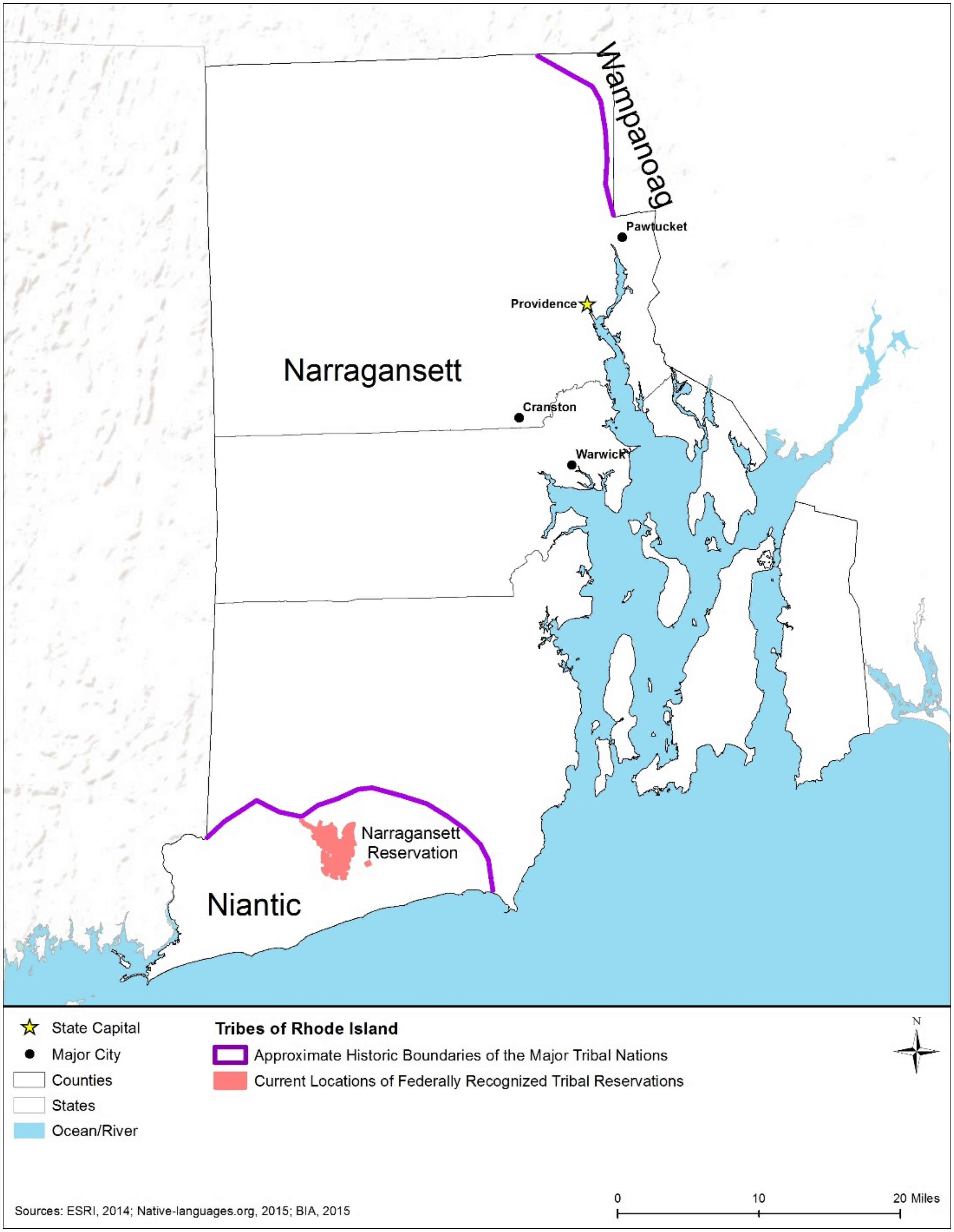

Figure 13.1.11-3: Historic Boundaries of Major Tribal Nations in Rhode Island

13.1.11.6. Significant Archaeological Sites of Rhode Island

Thousands of archaeological sites have been recorded in Rhode Island, 42 of which are listed on the NRHP. Below is a table showing the names of the sites, the city they are closest to, and type of site it is. Both prehistoric and historic archaeological sites are listed (Table 13.1.11-2). A complete listing of NRHP sites can be found on the National Parks Service NRHP website at http://www.nps.gov/nr/ (NPS, 2015d).

Table 13.1.11-2: Archaeological Sites on the National Register of Historic Places in Rhode Island

Closest City	Site Name	Type of Site
Albion	Sassafras Site, RI-55	Prehistoric
Bristol	Mount Hope Farm	Historic - Aboriginal
Charlestown	Fort Ninigret	Historic - Military
Charlestown	Foster Cove Archeological Site	Prehistoric
Charlestown	Historic Village of the Narragansetts in Charlestown	Historic - Aboriginal
Coventry	Carbuncle Hill Archaeological District, RI-1072-1079	Prehistoric
Coventry	Moosup River Site (RI-1153)	Prehistoric
Cranston	Furnace Hill Brook Historic and Archeological District	Historic - Aboriginal, Prehistoric
Cumberland	Furnace Carolina Site	Historic - Non-Aboriginal
East Greenwich	Tillinghast Mill Site	Historic - Non-Aboriginal
Exeter	Fisherville Historic and Archeological District	Historic - Non-Aboriginal
Exeter	Hallville Historic and Archeological District	Historic - Non-Aboriginal
Exeter	Parris Brook Historic and Archeological District	Historic - Aboriginal, Prehistoric
Exeter	Queen's Fort	Historic - Aboriginal
Exeter	Sodom Mill Historic and Archeological District	Historic - Non-Aboriginal
Foster	Breezy Hill Site (RI-957)	Prehistoric
Glocester	Chepachet Village Historic District	Historic
Glocester	Cherry Valley Archeological Site, RI-279	Prehistoric
Hopkinton	Tomaquag Rock Shelters	Historic - Aboriginal
Jamestown	Thomas Carr Farmstead Site (Keeler Site RI-707)	Historic - Non-Aboriginal
Jamestown	Fort Dumpling Site	Historic - Military
Jamestown	Hazard Farmstead (Joyner Site RI-706)	Prehistoric
Jamestown	Jamestown Archeological District	Historic - Non-Aboriginal, Historic - Aboriginal, Prehistoric
Jamestown	Old Friends Archeological Site	Prehistoric
Johnston	Ochee Spring Quarry	Prehistoric
Kingstown	George FayerweatherBlacksmith Shop	Historic - Non-Aboriginal
Kingstown	Lambda Chi Site, RI-704	Historic - Non-Aboriginal
Middletown	Gardiner Pond Shell Midden	Prehistoric
New Shoreham	Great Salt Pond Archeological District	Historic - Aboriginal, Prehistoric
Newport	Fort Hamilton Historic District	Historic - Military

Closest City	Site Name	Type of Site
Newport	Wanton--Lyman--Hazard House	Historic
North Kingston	Devil's Foot Cemetery Archeological Site, RI-694	Historic - Aboriginal
North Kingstown	Scrabbletown Historic and Archeological District	Historic - Non-Aboriginal
North Kingstown	Smith's Castle	Historic - Non-Aboriginal
North Kingstown	YWCA Site	Historic - Non-Aboriginal, Prehistoric, Historic - Aboriginal
North Smithfield	Three Dog Site, RI-151	Prehistoric
Portsmouth	Battle of Rhode Island Site	Historic - Military
Portsmouth	Pine Hill Archeological Site, RI-655	Prehistoric
Scituate	Double L Site, RI-958	Prehistoric
Scituate	McGonagle Site, RI-1227	Historic - Non-Aboriginal
Scituate	Millrace Site, RI-1039	Prehistoric
Scituate	Moswansicut Pond Site, RI-960	Prehistoric
Smithville	Woonasquatucket River Site (RI-163)	Prehistoric
South Kingston	Fernwood Archeological Site, RI-702	Prehistoric
South Kingstown	Jireh Bull Blockhouse Historic Site	Historic - Non-Aboriginal, Military
South Kingstown	Ministerial Rd. Site, RI-781	Prehistoric
South Kingstown	Mumford, Silas Site (Tappan Site RI-705)	Historic - Non-Aboriginal
South Kingstown	Potter Pond Archeological District	Prehistoric
South Portsmouth	Wreck Sites of H.M.S. Cerberus and H.M.S. Lark	Shipwreck
Tiverton	Fort Barton Site	Historic - Military
Usquepaug	Bouchard Archeological Site, RI-1025	Prehistoric
Warwick	Gaspee Point	Shipwreck
Warwick	Greenwich Cove Site	Prehistoric
Warwick	Lambert Farm Site, RI-269	Prehistoric
Warwick	Meadows Archeological District	Prehistoric
Warwick	Trafalgar Site, RI-639	Prehistoric
Westerly	Nursery Site, RI-273	Prehistoric
Wickford	Cocumscossoc Archeological Site	Historic - Aboriginal
Wyoming	Hillsdale Historic and Archeological District	Historic - Non-Aboriginal

Source: (NPS, 2015d)

13.1.11.7. Historic Context

The first Europeans, under the command of Giovanni Verrazzano, to explore Rhode Island arrived near present-day Newport, at the mouth of the Narragansett Bay, in 1524. In 1636, Roger Williams, a religious leader banished from Massachusetts, purchased the land that would become Providence from the Wampanoag tribe, marking the beginning of the colony of Rhode Island.[96] Williams would later sail to England to secure a royal charter for the colony to resolve territorial disputes with neighboring colonists. Williams sought to establish a colony based on

[96] In 1635, Roger Williams was banished from Massachusetts Bay Colony by the General Court of Massachusetts for opposing the right of civil authorities to punish religious dissension and to confiscate Indian land.

the principles of religious freedom and separation of church and state (Rhode Island Historical Preservation and Heritage Commission, 2012).

Colonists of Rhode Island generally had a respectful working relationship with the Indians of the area; however, King Philip's War in 1675-1676 resulted in the conquering and resettling of colonists on much of the remaining Indian land in Rhode Island. The colony's expansive coastline allowed maritime activities to thrive, and by the time of the American Revolution "twenty-nine towns had been established, of which two-thirds bordered the Narragansett Bay or Block Island Sound." Coastal fortifications and lighthouses populated the shorelines (Rhode Island Historical Preservation and Heritage Commission, 2012)

Newport and Providence were Rhode Island's two largest cities, with Newport being the more prominent during the 18th century, and Providence surpassing it during the 19th century. Rhode Island was involved heavily in the "Triangle Trade" during colonial times, which involved shipping sugar or molasses to England or New England for the production of rum, rum to West Africa for slaves, and then bringing slaves to the Caribbean to produce more sugar. Prior to the American Revolution, trading manufactured goods with England accounted for the colony's most profitable commerce (Rhode Island Historical Preservation and Heritage Commission, 2012).

Trade was interrupted during the American Revolution, particularly in Newport, which stunted the city economically for several years (Jordy, 2004). In spite of this, maritime activity in the state reached its peak during the late 18th century as Providence rose in importance (Rhode Island Historical Preservation and Heritage Commission, 2012). Rhode Island was beginning to industrialize as well, with the textile industry growing (Rhode Island Historical Preservation and Heritage Commission, 2012). In Pawtucket in 1792, Samuel Slater opened the first water-powered textile mill in America (Rhode Island Historical Preservation and Heritage Commission, 2015b). As road construction proliferated, interior portions of the state were able to be developed. Beginning in the early 19th century, mills were constructed along waterways, and where waterpower was unavailable, steam-powered mills were used instead (Rhode Island Historical Preservation and Heritage Commission, 2012).

During the Civil War, Rhode Island produced guns, ships, and machinery for the Union. A lack of cotton resulted in the closure of several textile factories; however, wool was produced in large quantities. By the close of the 19th century, mill villages and small urban areas occupied the countryside, with the majority of Rhode Islanders residing in urban centers. The shoreline of Rhode Island experienced growth as well, with the construction of resort communities and Gilded Age homes (Rhode Island Historical Preservation and Heritage Commission, 2012). Rhode Island grew as a vacation destination, which came to define the coast (Jordy, 2004).

Rhode Island experienced population growth through an influx of immigrants during the late 19th and early 20th centuries. Immigrants came to work in the factories and mills that populated the state. At the same time, the textile industry was shifting southward as a result of industrialization efforts following the Civil War. While the Great Depression resulted in the closure of additional factories, World War II (WWII) helped reignite economic activity in Rhode Island. Shoreline fortifications were renovated and naval facilities were expanded as a part of WWII (Rhode Island Historical Preservation and Heritage Commission, 2012).

In the 1940s and 1950s, Rhode Island experienced an increase in the development of rural areas with automobile suburbs. This resulted in a decline in urban populations as residents left cities in favor of suburbs, with businesses following suit. In the late 20th century, following decades of decline, cities begun experiencing a resurgence, with younger generations moving back into traditional urban cores (Rhode Island Historical Preservation and Heritage Commission, 2012).

Rhode Island has 771 NRHP listed sites, as well as 45 NHLS (NPS, 2015c). Rhode Island contains one NHA, the John H. Chafee Blackstone River Valley National Heritage Corridor, which stretches northward into neighboring Massachusetts (NPS, 2015k).

Figure 13.1.11-4 shows the location of Rhode Island's NHA and NRHP sites.[97]

13.1.11.8. Architectural Context

Architecture in Rhode Island evolved in a similar fashion to the rest of New England. During the 17th century, Post-Medieval structures were common and featured steeply pitched roofs, asymmetrical placements of casement windows, and massive central chimneys. One Rhode Island exception that is significant is the "Stone-ender" house type, a Rhode Island variation on Post-Medieval housing. Stone-enders were typical Post Medieval dwellings, except that one gable end was comprised entirely of a large stone chimney. The result was that the entire gable wall was stone, while the rest of the house (including the opposite gable end), was wood-framed with timbers (Rhode Island Historical Preservation and Heritage Commission, 2015c).

Residential construction evolved during the 18th and 19th centuries, with Georgian architecture being dominant during the 18th century until the American Revolution (Rhode Island Historical Preservation and Heritage Commission, 2015c). Newport includes a large collection of Georgian architecture, including many gambrel-roofed houses (Jordy, 2004). Following the American Revolution, Federal architecture became popular and remained so through the first quarter of the 19th century. Roofs were shallower, fanlights capped door surrounds, and windowpanes were larger. During the second quarter of the 19th century, Greek Revival became the dominant style in residential, commercial, and public architecture (Rhode Island Historical Preservation and Heritage Commission, 2015c). Providence contains many Federal and Greek Revival buildings as a result of its growth following the American Revolution, while Newport contains far less examples of either style (Jordy, 2004).

[97] See Section 13.1.7.4 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

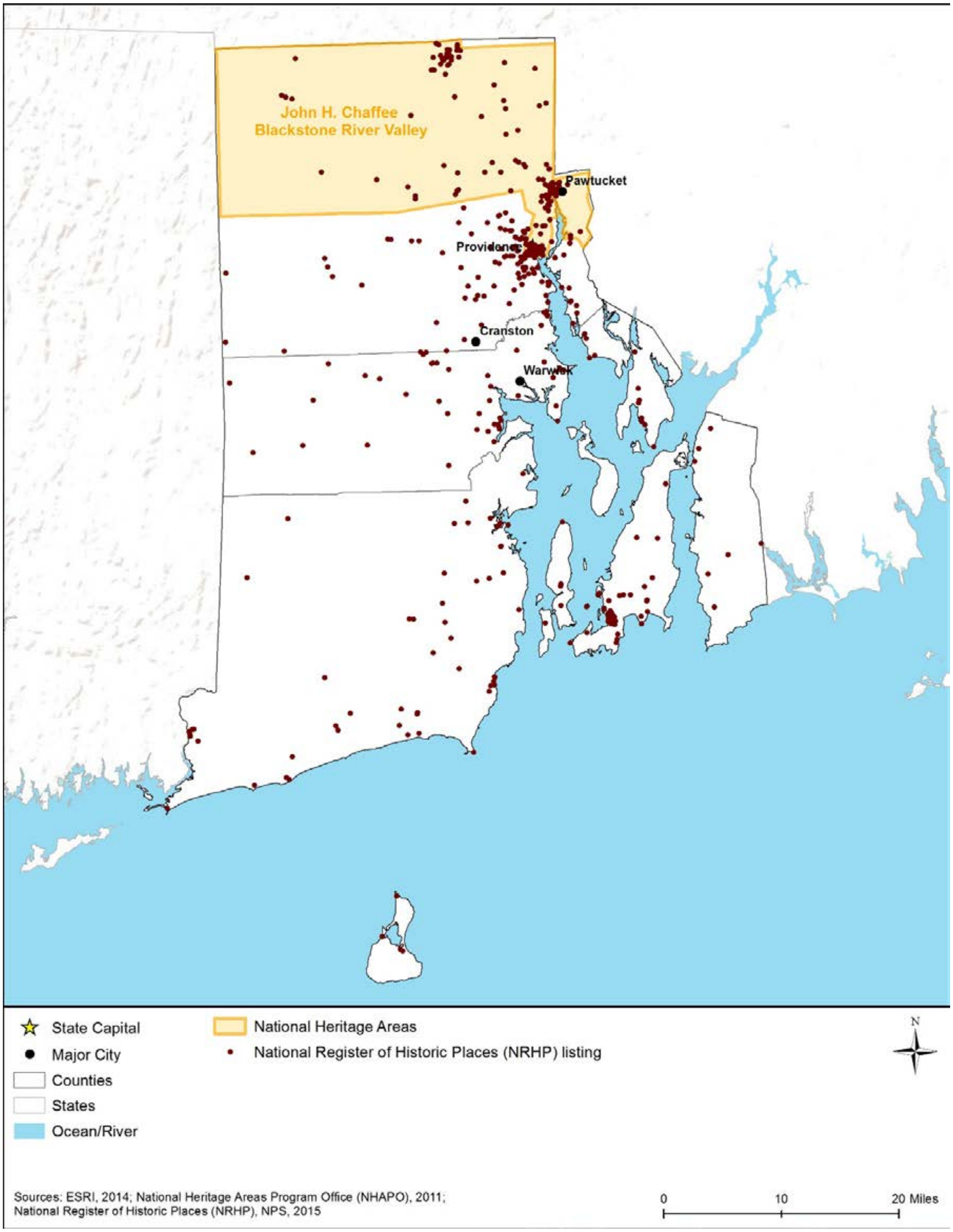

Figure 13.1.11-4: National Heritage Area (NHA) and National Register of Historic Places (NRHP) Sites in Rhode Island[98]

[98] 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.

Mid-19th century industrial advancements allowed architectural ornamentation to be mass produced, leading to the emergence of Victorian Era styles such as Gothic Revival, Italianate, Second Empire, Queen Anne, Stick, and Shingle. These were dominant from the second half of the 19th century through the early 20th century. During the late 19th and early 20th centuries, a number of Gilded Age resorts were constructed along Rhode Island's coasts, particularly around Newport, leading to Newport being known as the "Queen of Resorts" (Jordy, 2004). Following World War I (WWI), Colonial Revival architecture became popular, as did bungalows and minimal traditional houses. While suburban growth did occur in Rhode Island, it did not occur on the same level as it did elsewhere in the country (Rhode Island Historical Preservation and Heritage Commission, 2015c).

Moving beyond domestic architecture, Samuel Slater opened the first water-powered textile mill in America (in Rhode Island) in 1792, effectively beginning the Industrial Revolution (Rhode Island Historical Preservation and Heritage Commission, 2015c). Industrial architecture was constructed along waterways that could power mill machinery. While industrial resources were located throughout the state, a large number were in Providence, Pawtucket, and Woonsocket. Most of these early industrial structures have been adaptively reused to meet other needs or are interpreted historically (Rhode Island Historical Preservation and Heritage Commission, 2012).

Rhode Island has a collection of historic public buildings and houses of worship dating from the 17th century. The state has a Quaker meetinghouse built in 1699, several early Baptist structures, and what is believed to be the first purpose-built synagogue in America. Rhode Island contains historic public buildings of a variety of styles, including six existing state houses from different periods. Lighthouses populate the shoreline, as do historic fortifications and naval installations (Jordy, 2004). Rhode Island is home to Brown University, which dates to the 18th century, as well as several historic landscapes that have been preserved despite development pressures throughout the years (Rhode Island Historical Preservation and Heritage Commission, 2012).

Figure 13.1.11-5: Representative Architectural Styles of Rhode Island

- Top Left – Point Judith Lighthouse (Narragansett, RI) – (Highsmith, Point Judith Lighthouse, Narragansett, Rhode Island, 1980)
- Top Right – The Elms (Newport, RI) – (Historic American Buildings Survey, 1993a)
- Bottom Left – Thomas Clemence House (North Providence, RI) – (Historic American Buildings Survey, 1993b)
- Bottom Center – Slater Mill (Providence, RI) – (Historic American Engineering Record, 1968)
- Bottom Right – Federal Building and U.S. Courthouse (Providence, RI) – (Highsmith, Exterior, Federal Building and U.S. Courthouse, Providence, Rhode Island original digital file, 2007)

13.1.12. Air Quality

13.1.12.1. Definition of Resource

Air Quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography[99] 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)[100] or micrograms per cubic meter ($\mu g/m^3$)

[99] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[100] Equivalent to 1 milligram per liter (mg/L).

determined over various periods of time (averaging time).[101] This section discusses the existing air quality in Rhode Island. The USEPA designates areas within the United States as attainment,[102] nonattainment,[103] maintenance,[104] or unclassifiable[105] 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.

13.1.12.2. 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[106] or secondary,[107] 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. Rhode Island has not established its own ambient air quality standard but rather implements the federal NAAQS (RIDEM, 2013d).

In addition to the NAAQS, there are standards for hazardous air pollutants (HAP), which are those typically associated with specific industrial processes such as chromium electroplating (hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated solvents) (USEPA, 2011a). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. Appendix E presents a list of federally regulated HAPs.

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[101] 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, 2015i)

[102] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant. (USEPA, 2015j)

[103] 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, 2015j)

[104] 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, 2015j)

[105] 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, 2015j)

[106] 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, 2014d)

[107] 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, 2014d)

Title V Operating Permits/State Operating Permits

- Rhode Island 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, 2015k). The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (USEPA, 2015k). Rhode Island Air Pollution Control Regulation (RI APCR) 29.2 describes the applicability of Title V operating permits (RIDEM, 2011a). Rhode Island 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 13.1.12-1). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014e).

Table 13.1.12-1: Major Air Pollutant Source Thresholds

Any Pollutant	100 Tons per Year
Single HAP	10 Tons per Year
Total/Cumulative HAPs	25 Tons per Year

Source: (USEPA, 2014e)

Exempt Activities

A Minor Source is categorized as any emission source that does not meet the criteria of a Major Source, defined in Table 13.1.12-1. RI APCR 9.3.1 outlines the applicability of Minor Source Permits. The following sources are exempt from obtaining a Minor Source Permit:

- Any source the meeting the requirements of a Major Source Permit;
- Any fuel burning device designed to burn below the heat input capacities outlined in RI APCR 9.3.1(a):
- Liquid fuels (not including residual oil) at less than five million British thermal units per hour (Btu/hr);
- Gaseous fuels at less than ten million Btu/hr; or
- Alternative fuels[108] at less than one million Btu/hr; and
- Any emergency generator[109] or distributed generator,[110] with an initial startup on or after November 15, 2007, and a heat input capacity less than 350,000 Btu/hr, or an internal combustion engine with less than 50 horsepower (HP) (RIDEM, 2011b).

RI APCR 9.4 does not outline any exemptions for new major stationary sources or major modifications in nonattainment areas. Per RI APCR 9.5.4, major stationary sources or major modifications in attainment or unclassifiable areas may be exempt from Major Source Permits if:

[108] "…including but not limited to, wood chips, hazardous wastes or waste oil…" (RIDEM, 2011b)
[109] Emergency generator: "any generator used only during emergencies or for maintenance or testing purposes." (RIDEM, 2011b)
[110] Distributed generator: any generator not defined as an emergency generator. (RIDEM, 2011b)

- "The source or modification would be a major stationary source or major modification only if fugitive emissions, to the extent quantifiable, are considered in calculating the potential to emit of the stationary source or modification…; or
- The source or modification is a portable stationary source which has previously received a permit under the requirements of [RI APCR 9.5]; and if
- The source proposes to relocate and the emissions from the source at the new location would be temporary; and
- The emissions from the source would not exceed its allowable emissions; and
- The emissions from the source would impact no area where an applicable increment is known to be violated; and
- Reasonable notice is given to the Director [of Air Resources] prior to the proposed relocation identifying the proposed new location and the probable duration of operation at the new location. Such notice shall be given to the Director not less than thirty (30) days in advance of the proposed relocation.
- [An air quality impact analysis] shall not apply to a major stationary source or major modification if, with respect to a particular pollutant, the allowable emissions of that pollutant from a new source, or the net emissions increase of that pollutant from a modification would be temporary and impact no area where an applicable increment is known to be violated." (RIDEM, 2011b)

Operating permits include emergency provisions; allowing the source to exceed emission limits during an emergency. "Any situation arising from sudden and reasonably unforeseeable events beyond the control of the stationary source, including acts of God, which situation requires immediate corrective action to restore normal operation, and that causes the stationary source to exceed a technology-based emission limitation under the permit, due to unavoidable increases in emissions attributed to the emergency" (RIDEM, 2011a).

Appendix C of RI APCR No. 29 lists insignificant activities that are exempt from operating permits. Some of these activities include:

- "… Architectural maintenance activities for the buildings and structures at a stationary source such as painting, caulking reroofing, etc.;
- The engine of any vehicle, such as forklifts, tractors, construction equipment, motor vehicle, etc.; …
- … Electrically powered air compressors and pumps; …
- … All electric motors." (RIDEM, 2011a)

Temporary Emissions Sources Permits

Temporary permits are applicable to sources required to obtain a Minor Source Permit (see Section 13.1.12.2) if:

- "The stationary source is a portable engine or boiler that temporarily replaces an existing engine or boiler and the replacement units have a combined heat input capacity equal to or less than the existing units; or,

- The stationary source is an emergency generator that is to temporarily provide electrical power when the primary power source is disrupted or discontinued during an emergency due to circumstances beyond the control of the owner or operator of the facility; and,
- The duration of operation will not exceed 180 days." (RIDEM, 2011b)

The Rhode Island Department of Environmental Protection (RIDEP) can issue temporary stationary source operating permits as "a single permit authorizing emissions from similar operations by the same stationary source owner or operator at multiple locations. The operation must involve at least one change of location during the term of the permit" (RIDEM, 2011a).

State Preconstruction Permits

Minor Source Permits are required before construction, installation, or modification of:

- Any stationary source designed to burn:
- All liquid fuels (other than residual oil) with a heat input capacity of five million Btus/hr or more;
- Gaseous fuel with a heat input capacity of ten million Btu/hr or more; or
- Alternative fuels with a heat input capacity of one million Btus/hr or more. (RIDEM, 2011b)
- An emergency generator or distributed generator, with an initial startup on or after November 15, 2007, and a heat input capacity of 350,000 Btus/hr or more, or an internal combustion engine with 50 HP or more; or
- "Any stationary source that emits or has the potential to emit, in the aggregate, 25 tons per year or more of any combination of hazardous air pollutants." (RIDEM, 2011b)

If an emergency generator or distributed generator is required to obtain a Minor Source Permit and satisfies the following requirements, it is eligible for a General Permit:

- The emergency generator or distributed generator "has a heat input capacity of 350,000 Btus or more per hour or, in the case of internal combustion engines, is 50 HP or larger;" and
- The emergency generator or distributed generator "is not subject to or would not cause a facility to be subject to the major source permitting requirements of either [RI APCR 9.4 or 9.5]" (RIDEM, 2012b).

A General Permit is a "pre-approved minor source permit," and if a source does not meet the requirements for a Minor Source Permit (see Section 13.1.12.2), it is not eligible to obtain a General Permit. In addition, "generators whose engines are nonroad engines" are exempt from obtaining General Permits (RIDEM, 2012b).

RI APCR No. 9 requires all major stationary sources and major modifications in nonattainment areas to obtain a Major Source Permit. Major sources and major modifications in attainment and unclassifiable areas must obtain a major source permit "for any pollutant for which there is a significant net emissions increase at the source or modification" (RIDEM, 2011b). Sources are required to apply best available control technology, as well as to conduct an air quality impact analysis.

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, 2013b). 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 six months after beginning response activities, will be exempt from any conformity determinations (USGPO, 2010).

The estimated pollutant emissions are compared to *de minimis*[111] levels. These values are the minimum thresholds for which a conformity determination must be performed (Table 13.1.12-2). All Rhode Island counties lie in the Ozone Transport Region (OTR). As a result, lower *de minimis* thresholds for VOCs and NO_X could apply depending on the attainment status of a county.

Table 13.1.12-2: De Minimis Levels

Pollutant	Area Type	TPY
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
Ozone (NO_X)	Marginal and Moderate Nonattainment inside an OTR	100
	Maintenance	100
Ozone (VOC)	Marginal and Moderate Nonattainment inside an OTR	50
	Maintenance within an OTR	50
CO, SO_2, NO_2	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ (Direct Emissions) (SO_2) (NO_X (unless determined not to be a significant precursor)) (VOC or ammonia (if determined to be significant precursors))	All Nonattainment and Maintenance	100
Lead	All Nonattainment and Maintenance	25

Source: (USGPO, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 13.1.12-2, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 13.1.12-2, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not

[111] Small amount or minimal

cause a new violation of the NAAQS. To demonstrate conformity[112], the agency would have to fulfill one or more of the following:

- Show any emissions increase is specifically identified and accounted for in the respective state's SIP;
- Receive acknowledgement from the state that any increase in emissions would not exceed the SIP emission budget;
- Receive acknowledgement from the state to revise the SIP and include emissions from the action;
- Show the emissions would be fully offset by implementing reductions from another source in the same area; and
- Conduct air quality modeling that demonstrates the emissions would not cause or contribute to new violations of the NAAQS, or increase the frequency or severity of any existing violations of the NAAQS (USEPA, 2010).

State Implementation Plan (SIP) Requirements

Rhode Island's SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Rhode Island's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Rhode Island's SIP actions are codified under 40 CFR Part 52 Subpart OO. A list of all SIP actions for all six criteria pollutants can be found on the RIDEM website (RIDEM, 2015q).

13.1.12.3. 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 3.12.3-1 and Table 3.12.3-3, below, present the current nonattainment areas in Rhode Island as of January 30, 2015. Table 13.1.12-3 contains a list of the counties and their respective current nonattainment status for each criteria pollutant. The year(s) listed in the table for each pollutant indicate when USEPA promulgated the AAS for that pollutant. Unlike **Table *13.1.12-3***, Figure 13.1.12-1 does not differentiate between standards for the same pollutant. Additionally, given that particulate matter is the criteria pollutant of concern, PM_{10} and $PM_{2.5}$ are merged in the figure and presented as a single pollutant.

[112] Conformity: Compliance with the State Implementation Plan.

Table 13.1.12-3: Rhode Island Nonattainment and Maintenance Areas by Pollutant Standard and County

County	Pollutant and Year USEPA Implemented Standard										
	CO	Lead		NO_X	PM_{10}	$PM_{2.5}$		O_3		SO_X	
	1971[a]	1979	2008	1971	1987	1997	2006	1997	2008	1971	2010
Bristol								X-4			
Kent								X-4			
Newport								X-4			
Providence								X-4			
Washington								X-4			

Source: (USEPA, 2015l)

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
[a] The years under each pollutant represent the year that the specific national standard was implemented.

Figure 13.1.12-1: Nonattainment and Maintenance Counties in Rhode Island

Air Quality Monitoring and Reporting

RIDEM measures air pollutants at eight sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network (RIDEM, 2015v). Annual Rhode Island Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. RIDEM reports real-time levels of O_3 and PM on their website because of the health concerns associated with those pollutants (RIDEM, 2015q).

The only criteria pollutant in nonattainment is O_3. Based on information on USEPA's website, from January to September 2014 O_3 measurements in the state did not exceed the federal standard of 0.075 ppm (USEPA, 2014f). RIDEM posted Air Quality Data Summaries from 2003 through 2011. Based on this data, O_3 measurements exceeded the federal standard of 0.075 ppm 10 times in 2011. Four of these exceedances, the highest number of any station, occurred at the University of Rhode Island's Alton Jones station in West Greenwich, located approximately 23 miles southwest of Warwick (RIDEM, 2011c) USEPA data for 2015 indicates that the state once again exceeded the 0.075 ppm standard and is currently in nonattainment (USEPA, 2014f).

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). Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size. Class I areas cannot be re-designated as Class II or Class III and are intended to maintain pristine air quality. Although 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 (USEPA, 2013c).

- In a 1979 USEPA memorandum, the Assistant Administrator for Air, Noise, and Radiation (Hawkins, 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[113] of a Class I area. "The EPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (Page, 2012). The 2005 USEPA guidelines for air quality modeling do not provide a precise modeling range for Class I areas.
- PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model

[113] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.

beyond the point of significant impact or the source or 50 kilometers[114] (the normal useful range of EPA-approved Gaussian plume models" (USEPA, 1992).

- Rhode Island does not contain any federal Class I areas; all land within the state is classified as Class II (USEPA, 2012c). If an action is considered a major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 50 kilometers from the source (USEPA, 1992).

13.1.13. Noise

This section presents a discussion of a basic understanding of environmental noise, background/ambient noise levels, noise standards, and guidelines.

13.1.13.1. Definition of the Resource

Noise is a form of sound caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012d). 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 normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 2015g). The A-weighted scale, denoted as dBA, approximates the range of human hearing by filtering out lower frequency noises, which are not as damaging as the higher frequencies. The dBA scale is used in most noise ordinances and standards (OSHA, 2013).

Measurements and descriptions of noise (i.e., sounds) are based on various combinations of the following factors (FTA, 2006):

- The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound.
- 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.

[114] The memorandum and associated guidance use kilometers. 50 kilometers is equal to about 31 miles.

- The changes in frequency characteristics or pressure levels through time.

Figure 13.1.13-1 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.

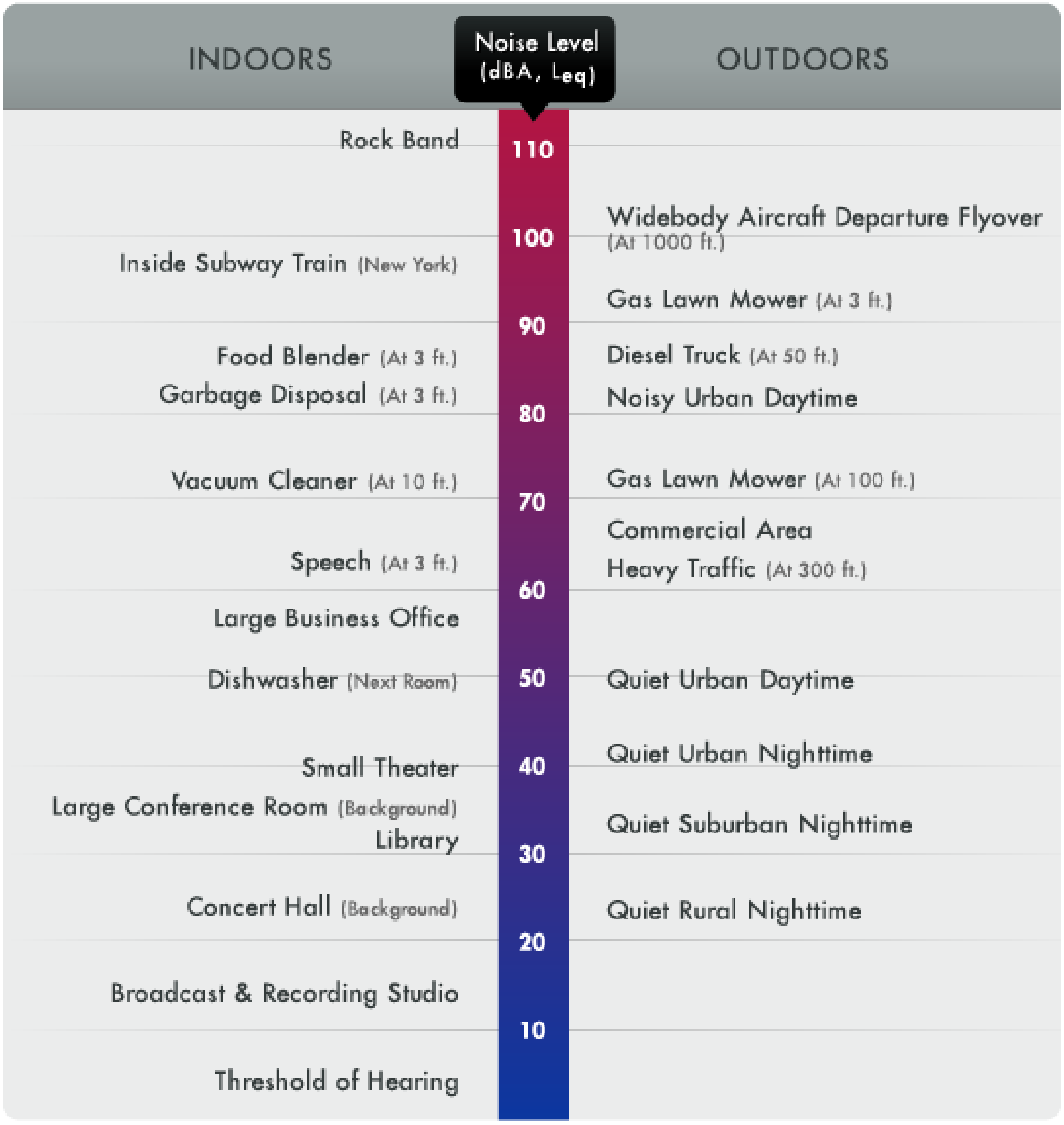

Figure 13.1.13-1: Sound Levels of Typical Sounds

Source: (Sacramento County Airport System, 2015)
Prepared by: Booz Allen Hamilton, 2005.

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 (FTA, 2006):

- A 3-dB change in sound level is considered a barely noticeable difference;
- A 5-dB change in sound level will typically result in a noticeable community response; and
- A 10-dB change, which is generally considered a doubling of the sound level, almost certainly causes an adverse community response.

In general, ambient noise levels are higher during the day than at night and typically this difference is about 10 dB (USEPA, 1973). Ambient noise levels can differ considerably depending on whether the environment is urban, suburban, or rural.

13.1.13.2. Specific Regulatory Considerations

As identified in Appendix C, 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.

Rhode Island has several statewide noise laws that apply to motor vehicles (State of Rhode Island, 2014). In addition, many cities and towns may have local noise ordinances to further manage community noise levels. Large cities and towns, such as Providence, 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). Table 13.1.13-1 summaries Rhode Island's relevant noise laws.

Table 13.1.13-1: Relevant Rhode Island Noise Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
General Laws Title 31: Motor and Other Vehicles	Rhode Island GA	Defines the maximum permissible noise level while operating a motor vehicle
General Laws Title 31: Motor and Other Vehicles	Rhode Island GA	Refers to the requirements to use a muffler on a motor vehicle

Source: (State of Rhode Island, 2014)

13.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in Rhode Island varies widely based on the area and environment. The population of Rhode Island can choose to live and interact in areas that are large cities, suburban neighborhoods, rural communities, and national and state parks. Figure 13.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Rhode Island may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Rhode Island. As such, this section describes the areas where the population of Rhode Island can potentially be exposed to higher than average noise levels.

- **Urban Environments:** Urban areas are likely to have higher noise levels on a daily basis due to highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (USDOI, 2008). The urban areas that are likely to have the highest ambient noise levels in the state are Providence, Warwick, Cranston, and Pawtucket.
- **Airports:** Areas surrounding airports tend to have higher noise levels due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2007). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports is in proximity to urban communities, resulting in noise exposure from aircraft operations (arrivals/departures) to the surrounding areas at higher levels and with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In Rhode Island, Theodore Francis Green State International (PVD), Block Island State airport (BID), and Westerly State airport (WST) have combined annual operations of more than 74,000 flights (FAA, 2015h). These operations result in increased ambient noise levels in the surrounding communities.
- **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, 2015). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living near those traffic corridors. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA, 2015). See Section 13.1.1.3, Public Safety Services, and Figure 13.1.1-1 for more information about the major highways in the state.
- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (FTA, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (FRA, 2015). Rhode Island has multiple rail corridors with high levels of commercial and commuter rail traffic. The Amtrak Northeast Corridor goes through Rhode Island at Westerly, Kingston, and Providence. The Massachusetts Bay Transportation Authority also operates commuter rail services, connecting Wickford Junction (RI) to TF Green Airport (RI), Providence (RI), and South Attleboro (MA) (Rhode Island Department of Administration, Division of Planning, 2014b).

See Section 13.1.1.2, Transportation, and Figure 13.1.1-1 for more information about rail corridors in the state.

- **National and State Parks:** The majority of national and state parks are likely to have lower than average ambient noise levels given their size and location in wilderness areas. National and state parks, historic areas, and monuments are protected areas, which are regions that are given legal safeguards in order to maintain biological diversity and natural resources (NPS, 2013). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014d). Rhode Island has two national parks[115] and one National Natural Landmark (National Parks Conservation Association, 2015) (NPS, 2015c). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 13.1.8, Visual Resources for more information about national and state parks for Rhode Island.

13.1.13.4. 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 Rhode Island 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 Rhode Island.

13.1.14. Climate Change

13.1.14.1. 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, 2012e). 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[116]), which equalizes for the

[115] This count is based on the NPS website "by the numbers" current as of 9/30/2014 (NPS, 2015c). Actual lists of parks and NPS affiliated areas may vary here depending on when areas are designated by Congress.
[116] 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, 2016)

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 Section 13.2.14, Environmental Consequences). Existing climate conditions in the project area are described first by state and sub-region, where appropriate. 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).

13.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C. Rhode Island has established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 13.1.14-1, two key state laws/regulations are the primary policy drivers on climate change preparedness and GHG emissions.

Table 13.1.14-1: Relevant Rhode Island Climate Change Laws and Regulations

State Laws/Regulations	Regulatory Agency	Applicability
Executive Order 14-01: Executive Climate Change Council (February 2014)	State of Rhode Island	In February, 2014, Governor Chafee signed Executive Order 14-01, creating the Rhode Island Executive Climate Change Council (EC3). The Governor directed the Council was to develop a comprehensive approach to address the potential threats from climate change, the State's environment, economy and its people. The EC3 is directed to address both GHG emissions reductions and how to prepare for and adapt to climate change impacts that are already underway or cannot be prevented. (Rhode Island Department of Administration, Division of Planning, 2014c)
The Senate Climate Change Bill (2952 sub A): Resilient Rhode Island Act (July 2014)	State of Rhode Island	The Resilient Rhode Island Act builds on Executive Order 14-01. The purpose of the bill is "to protect the people of Rhode Island and make the state economy and society resilient in the face of the nearly certain, but not precisely predictable, effects of climate change (Resilient Rhode Island, 2014)." The bill directs the EC3 to submit to the Governor and General Assembly a plan that includes strategies, programs and actions to meet the following targets for GHG reductions: (i) Ten percent (10%) below 1990 levels by 2020; (ii) Forty-five percent (45%) below 1990 levels by 2035; (iii) Eighty percent (80%) below 1990 levels by 2050 (Resilient Rhode Island, 2014). The bill also includes measures for adapting to climate change. (Resilient Rhode Island, 2014)

Rhode Island is also one of nine states participating in the Regional Greenhouse Gas Initiative (RGGI). RGGI is a CO_2 emissions trading scheme, launched in 2008, which sets an annual cap on CO_2 emissions from power plants over 25 MW capacity within those nine states. The cap for 2015 was set at 88.7 million short tons of CO_2, with an annual reduction of 2.5 percent per year until 2020 (RGGI, 2015).

13.1.14.3. Rhode Island Greenhouse Gas Emissions

Estimates of Rhode Island's total GHG emissions vary. The Department of Energy's Energy Information Agency (EIA) collects and disseminates national-level data on emissions of CO_2 from fossil fuels by state. In addition, EIA maintains data on other GHGs such as CH_4 and nitrous oxide (NO_x), but these are not broken down by state (EIA, 2011). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015m). 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.

CO_2 emissions from fossil fuels in Rhode Island were 10.3 MMT of CO_2 in 2012. Rhode Island's CO_2 emissions grew steadily from 8.3 MMT in 1980 to a peak of 13.0 MMT in 1999, and then declined to their 2012 levels as a result of long-term reductions in emissions from both petroleum and natural gas (EIA, 2015e). Rhode Island is the third-smallest emitter of CO_2 from fossil fuels and is one of only two states in the U.S. that has no coal-fired electricity generation (EIA, 2015f).

Table 13.1.14-2: Rhode Island CO_2 Emissions from Fossil Fuels by Fuel Type and Source, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	0.0	Residential	2.2
Petroleum Products	5.3	Commercial	0.9
Natural Gas	4.7	Industrial	0.6
		Transportation	3.7
		Electric Power	2.6
TOTAL	10.0	TOTAL	10.0

Source: (EIA, 2015e)

According to the EIA, Rhode Island emitted a total of 10.0 MMT of CO_2 in 2013. Transportation was the largest emitter, accounting for more than 75 percent of total CO_2 emissions (Table 13.1.14-2) (EIA, 2015g). Rhode Island's CO_2 emissions grew steading from 8.3 MMT in 1980 to a peak of 13.0 MMT in 1999, and declined to their current levels. Reductions in CO2 emissions were the result of long-term declines in emissions from both petroleum and natural gas (EIA, 2015g). In 2013, Rhode Island ranked 49th among the 50 states and the District of Columbia for total CO_2 emissions, and 47th for per-capita CO_2 emissions (EIA, 2015h).

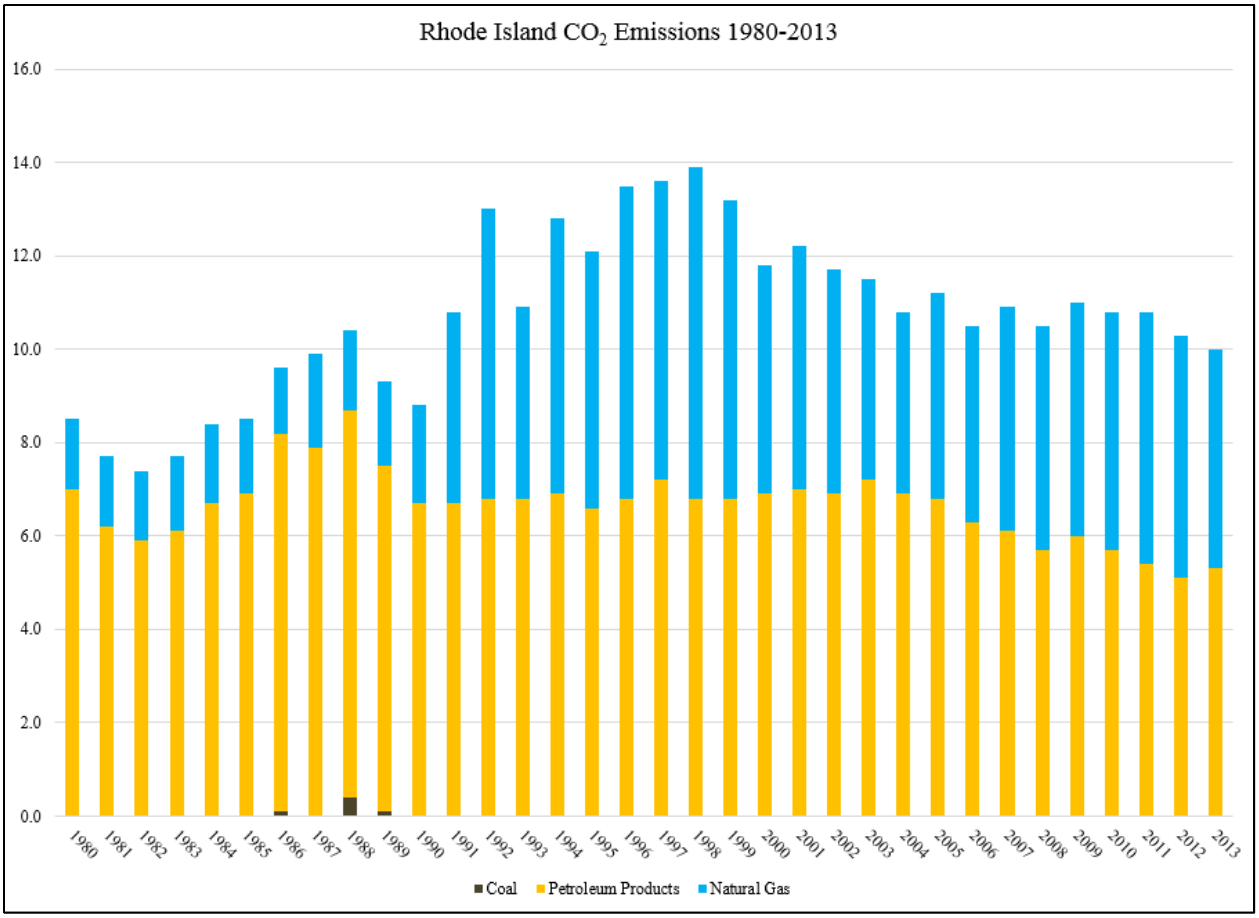

Figure 13.1.14-1: Rhode Island CO_2 Emissions from Fossil Fuels by Fuel Type, 1980-2013

Source: (EIA, 2015e)

In 2012, Rhode Island contracted with the Northeast States for Coordinated Air Use Management (NESCAUM) to complete an inventory of Rhode Island's 2010 GHG emissions (RIDEM, 2012c) . The report concluded that the majority of Rhode Island's GHG emissions (10.0 MMT) is CO_2. Other major GHGs emitted in Rhode Island are methane (CH_4), hydrofluorocarbons (HFC), nitrous oxide (NO_x), sulfur hexafluoride (SF_6), and perfluorocarbons (PFC). At 30.1 percent, the transportation sector, specifically highway vehicles, accounted for the majority of CH_4 and NO_x emissions in 2010 due high gasoline and diesel fuel consumption. A small percentage may result from leakage from air conditioning (RIDEM, 2012c).

Rhode Island's CO_2 emissions are mostly from oil and natural gas combustion in the energy and transportation sectors, and natural gas for heat and hot water in residential and commercial buildings. Overall, Rhode Island's GHG emissions from fossil fuels have declined since 1997, although holding steady in recent years with petroleum product consumption continuing to decline, but natural gas consumption increasing or decreasing slightly depending on the year (RIDEM, 2012c).

Energy-related activities such as highway vehicles (30.1 percent), electric power generation (26 percent), residential heating (19 percent) and commercial heating (8 percent) had the greatest impact on GHG emissions in Rhode Island between 1990 and 2010 (RIDEM, 2012c).

The electric power generation sector emissions experienced growth of 2.4 MMT CO_2e between 1990 and 2010. Despite the lower CO_2 emissions rates from the newer plants, GHG emissions have increased because four of the five power plants in Rhode Island began operating after 1990. Rhode Island electricity generation emissions data may not be accurate because it is one of six states included in the ISO-New England regional power grid, is a net exporter of power, and attributing emissions in such a system is prone to uncertainty (RIDEM, 2012c). The state's electricity usage is consistently low because air conditioning use is limited in the summer.

13.1.14.4. 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).

Cfa – Rhode Island falls into the climate group (C) (Figure 13.1.14-2). Climates classified as (C) are generally warm, with humid summers and mild winters (NWS, 2011a) (NWS, 2011b). Rhode Island's secondary classification indicates year-round rainfall, but it is highly variable; convective thunderstorms are dominant during summer months. During winter months, "the main weather feature is the mid-latitude cyclone" (NWS, 2011a) (NWS, 2011b). The tertiary classification indicates mild, hot summers with average temperature of warm months over 72 °F. Average temperatures of the coldest months are under 64 °F (NWS, 2011a) (NWS, 2011b).

In Rhode Island, there are "three topographical divisions of the State" (CoCoRaHS, 2015). The first is a "narrow coastal plain" that "lies along the south shore and around Narragansett Bay with an elevation of less than 100 feet" (CoCoRaHS, 2015). The second division "lies to the north and east of the Bay with gently rolling uplands of up to 200 feet" (CoCoRaHS, 2015). The third division is located in the "western two-thirds of Rhode Island," and consists of "predominantly hilly uplands of mostly 200 to 600 feet elevation but rising to a maximum of 800 feet above sea level in the northwest corner of the State" (CoCoRaHS, 2015). "The chief characteristics of Rhode Island's climate may be summarized as follows: (1) equitable distribution of precipitation among the four seasons; (2) large ranges of temperature both daily and annually; (3) great differences in the same season of different years; and (4) considerable diversity of the weather over short time periods. These characteristics are modified by nearness to the Bay or ocean, elevation and nature of the terrain" (Guiliano, 2015).

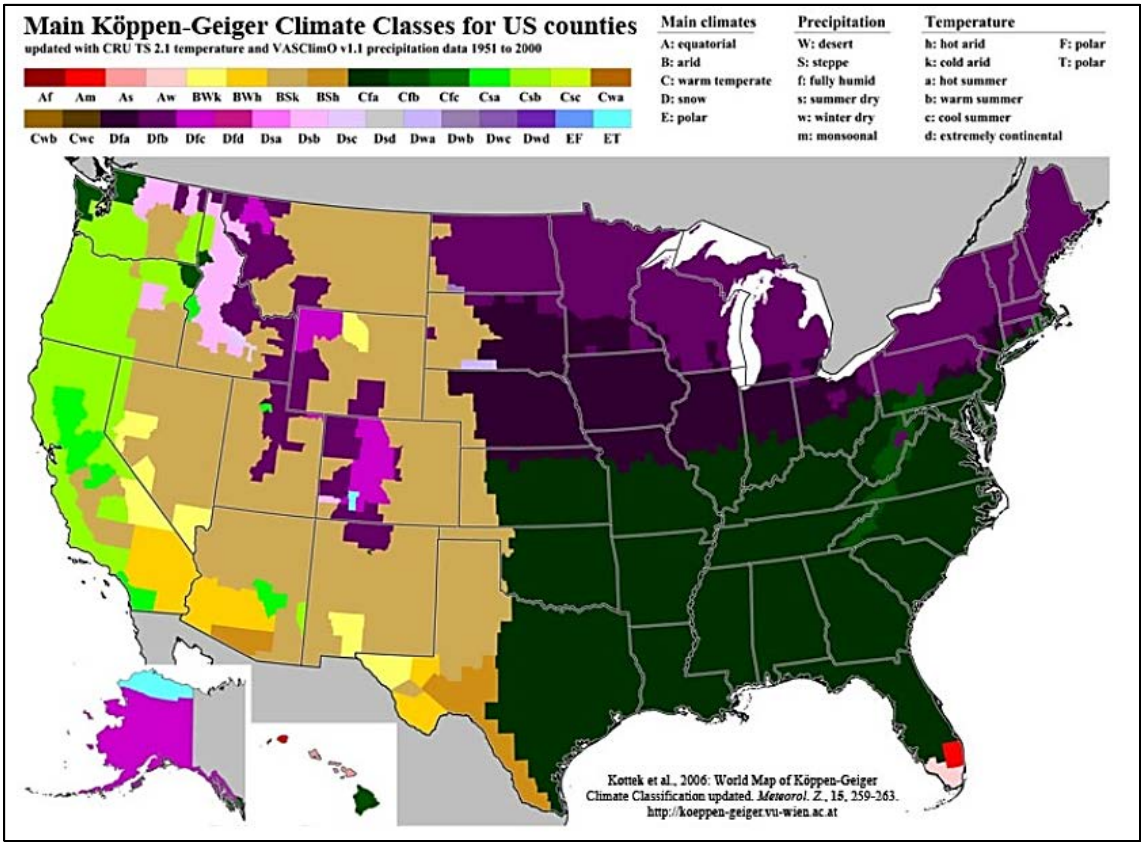

Figure 13.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, 2006)

This section discusses the current state of Rhode Island's climate with regard to temperature, precipitation, sea level, stream flow, and extreme weather events (e.g., tropical storms, tropical cyclones, and hurricanes) in Rhode Island's climate region, Cfa.

Rhode Island "lies in the prevailing westerlies, the belt of generally eastward air movement which encircles the globe in the middle latitudes" (Guiliano, 2015). "Embedded in this circulation are extensive masses of air originating in higher and lower latitudes and interacting to produce storm systems" (Guiliano, 2015). "A large number of these systems and air mass fronts pass near or over Rhode Island in a year" (Guiliano, 2015). These air masses typically lead to "abrupt changes in temperature, moisture, sunshine, wind direction, and speed" (Guiliano, 2015). This day-to-day variability, "is the main feature of Rhode Island's weather" (Guiliano, 2015).

Air Temperature

Generally, Rhode Island experiences "large ranges of temperature" variations, both daily and annually (CoCoRaHS, 2015). Many of these "characteristics are modified by nearness to the Bay or ocean, elevation, and nature of the terrain" (CoCoRaHS, 2015). Statewide, the average annual temperature is 48.8 °F (NOAA, 2015h). Areas such as Narragansett Bay and Providence have a slightly higher regional average of 51 °F. Areas that are further inland (approximately 10 miles) experience slightly a cooler average temperature that generally remains below 48 °F (CoCoRaHS, 2015). The highest temperature to occur in Rhode Island was on August 2, 1975 with a record high of 104 °F (SCEC, 2015). The coldest temperature to occur in Rhode Island was on January 11, 1942 with a record low of negative 28 °F (SCEC, 2015).

The following paragraphs describe temperatures in Rhode Island they occur within a Cfa climate classification zone:

Cfa – Providence, in northern Rhode Island, is within the climate classification group Cfa. The average annual temperature for this area is approximately 51.6 °F (NOAA, 2015i). During winter months, the average annual temperature in Providence is 31.8 °F; 71.3 °F during summer months; 48.8 °F during spring months; and 54.3 °F during autumn months (NOAA, 2015i). Throughout most of the state (approximately two-thirds), temperatures during January and February reach an "average daily minimum temperature" of 19 to 20 °F (CoCoRaHS, 2015). Throughout the rest of the state, average daily minimum temperatures increase to approximately 25 °F (CoCoRaHS, 2015). In coastal and Bay areas, "the number of days with minimum temperatures of 0 °F or below averages one or less per year" (CoCoRaHS, 2015). "A maximum temperature of 32 °F or lower occurs on an average of 20 to 25 days per year along the shoreline and 30 to 40 days in the remainder of the State" (CoCoRaHS, 2015).

"The greatest number of hot days occur in the metropolitan areas in and parts of the northern interior" (CoCoRaHS, 2015). In these areas, "about eight to 10 days of temperatures of 90 °F or higher may be expected each year" (CoCoRaHS, 2015). "Near the immediate coast, the occurrence of 90 °F temperatures is limited to one day in an average summer, if it occurs at all" (CoCoRaHS, 2015). Since the 1930s, "temperatures have been steadily climbing" in Rhode Island. "The average annual temperature for the state is currently increasing at a rate of 1 °F every 33 years" (Vallee & Giuliano, 2014).

Precipitation

"The climate of Rhode Island is characterized by the rather even distribution of precipitation throughout the year" (CoCoRaHS, 2015). Throughout (CoCoRaHS, 2015) Rhode island, "storm centers and their accompanying fronts are the principal year-round producers of precipitation" (CoCoRaHS, 2015). Storms from the Atlantic Ocean "generally yield the heaviest amounts of rain and snow," however thunderstorms also "contribute considerable precipitation in the summer" in Rhode Island (CoCoRaHS, 2015). Throughout most of the state, the average annual precipitation ranges from 42 to 46 inches, "with a tendency for decreasing amounts from west to east" (CoCoRaHS, 2015). Precipitation totals vary "from about 40 inches in the immediate southeastern Bay area" to "48 inches in the western uplands" (CoCoRaHS, 2015). The average total precipitation during May, June, and July is approximately 2.5 to three inches. The average total precipitation during October and February is "slightly more than three inches over most of the State" (CoCoRaHS, 2015). "The remaining months each yield from 3.5 to four inches" (CoCoRaHS, 2015).

In addition to heavy rainfall, Rhode Island receives an abundance of snowfall. On average, southeastern areas, receive approximately 20 inches of annually, while western areas of the state receive between 40 and 55 inches on annually (CoCoRaHS, 2015). “Areas near the western and northern shores of the Bay, including greater Providence, have an average range from 25 to 30 inches of snow per year” (CoCoRaHS, 2015). Since the 1930s, “the average annual precipitation for Rhode Island” has increased by “a rate of more than one inch every 10 years” and “the frequency of days having one inch of rainfall has nearly doubled” (Vallee & Giuliano, 2014).

Cfa – Providence, located in northern Rhode Island, is within the climate classification group Cfa. The average annual precipitation accumulation for this area is approximately 47.18 inches (NOAA, 2015i). During winter months, the average annual precipitation accumulation in Providence is 11.37 inches; 10.53 inches during summer months; 12.92 inches during spring months; and 12.36 inches during autumn months (NOAA, 2015i). The greatest annual precipitation accumulation occurred between September 16 and 17, 1932 with a total of 12.13 inches in 24-hours (SCEC, 2015). The greatest annual snowfall accumulation occurred on February 7, 1978 with a total of 30 inches in 24-hours (SCEC, 2015).

Sea Level

Rhode Island, referred to as the “Ocean State,” has approximately 384 miles of tidal shoreline (State of Rhode Island, 2015d). Much of this shoreline is at risk for damage from strong winds, heavy rainfall, flooding, and hurricanes. Since 1938, sea level in Providence has risen approximately 0.74 feet, with an approximate rise of 2.25 millimeters/year (NOAA, 2013b). Since 1930, sea level in Rhode Island has risen approximately 0.90 feet, with an approximate rise of 2.74 millimeters/year (NOAA, 2013b). Sea level rise in Rhode Island is mostly due to increasing thermal expansion and melting land-based ice sheets (University of Rhode Island, 2013). As sea level continues to rise, the risks associated with living along the coast also rise. Superstorm Sandy highlighted the risks and vulnerabilities of living near unprotected tidal shoreline (NYSDEC, 2015b).

Severe Weather Events

Increasing precipitation in Rhode Island has “resulted in a much wetter state in terms of soil moisture and the ground’s ability to absorb rainfall,” leading to an increase in the “potential for flooding on the state’s rivers and streams” (Vallee & Giuliano, 2014). “Basins that have experienced considerable urbanization will have far less capacity to handle the additional runoff compared to a basin in which there remains considerable natural storage or less urbanization over time” (Vallee & Giuliano, 2014). “Similarly, basins which may have flood control structures may not necessarily see an increase in the severity of flooding but may see in increase in the frequency of less severe floods” (Vallee & Giuliano, 2014). In Rhode Island, one recent flooding event was particularly severe, The Great Flood of 2010 (NOAA, 2015j). “The Great Flood of 2010 occurred in March and early April 2010” (NOAA, 2015j). This flooding event was the result of “a series of moderate to heavy rainfall events over a 5-week period during late February through late March” (NOAA, 2015j). The final rainfall event occurred between March 29 and 31st, adding an additional six to ten inches of rain to rivers and streams that “were only slightly below flood stage at the onset of this rainfall" (NOAA, 2015j). As a result, "all counties in Rhode Island were included in a FEMA Major Disaster Declaration; nearly 26,000 residents applied for assistance; with $79 million in disaster assistance approved for individuals and business owners" (NOAA, 2015j).

Rhode Island has experienced three particularly severe Hurricane and subsequent flooding events: The Great New England Hurricane of 1938, Hurricane Carol 1954, and Connie and Diane in 1955 (NOAA, 2015j). The Great New England Hurricane of 1938 "was one of the most destructive and powerful storms to ever strike southern New England" (NOAA, 2015j). Sustained winds on Block Island reached 91 mph, with gusts of up to 121 mph. In addition to destructive winds, the hurricane also resulted in widespread storm surge flooding. "Narragansett Bay took the worst hit, where a storm surge of 12 to 15 feet destroyed most coastal homes, marinas, and yacht clubs" (NOAA, 2015j). Princeton was also affected by a 20-foot storm surge that submerged the city. This hurricane resulted in the death of 564 people and approximately 1,700 injuries throughout southern New England. "A total of 2,605 vessels were destroyed, with 3,369 damaged. "A total of 8,900 homes, cottages and buildings were destroyed, and over 15,000 were damaged by the hurricane" (NOAA, 2015j).

In 1954, Hurricane Carol struck Rhode Island. This hurricane was the "most destructive hurricane to strike southern New England since the Great New England Hurricane of 1938" (NOAA, 2015j). Hurricane Carol "sustained winds of 80 to 100 mph," affecting the entire state of Rhode Island. "Storm surge levels ranged from 10 to 15 feet" (NOAA, 2015j). "Narragansett Bay received the largest surge values of over 14 feet in the upper reaches of the water way" (NOAA, 2015j). "On Narragansett Bay, just north of the South Street Station site, the surge was recorded at 14.4 feet, surpassing that of the 1938 hurricane" (NOAA, 2015j). Once again, coastal communities were devastated, resulting in the destruction of approximately 4,000 homes, approximately 3,500 automobiles, and 3,000 boats. The entire state of Rhode Island lost electrical power due to Hurricane Carol, with an estimated 95 percent of the population losing phone power (NOAA, 2015j).

In 1955, Tropical Storm systems Connie and Diane struck Rhode Island. "Connie produced three to five inches of rain across Rhode Island," and "just one week later, Diane brought three to six inches of rain to central and southern Rhode Island, and seven to 10-plus inches of rain to the northern portion of the state" (NOAA, 2015j). With over a foot of rainfall from Tropical Storm Diane, record flood levels occurred in the upper Blackstone River, resulting in "devastating record floodwaters in the headwaters of the Blackstone River Valley and into the city of Woonsocket" (NOAA, 2015j). Dam failures in the area also added to the destructiveness of these Tropical Systems (NOAA, 2015j).

13.1.15. Human Health and Safety

13.1.15.1. Definition of the Resource

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the deployment, operation, and maintenance of towers, antennas, cables, utilities, and other equipment and infrastructure at existing and potential

FirstNet telecommunication sites. There are two human populations of interest within the existing environment of health and safety, (1) telecommunication occupational workers and (2) the general public near telecommunication sites. Each of these populations could experience different degrees of exposure to hazards as a result of their relative access to FirstNet telecommunication sites and their function throughout the deployment of the FirstNet telecommunication network infrastructure.

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation, vehicular traffic or the transportation of hazardous materials and wastes. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 13.1.1.5, Infrastructure.

13.1.15.2. Specific Regulatory Considerations

Federal organizations, such as OSHA, USEPA, the U.S. Department of Health and Human Services, and others, protect human health and the environment. In Rhode Island, the Rhode Island Department of Labor and Training (RIDLT), Workforce Regulation and Safety regulates occupational safety, and the RIDEM, Bureau of Environmental Protection regulates waste and environmental pollution. Federal OSH regulations apply to workers through either OSHA, or stricter state-specific plans, which must be approved by OSHA. Rhode Island does not have an OSHA-approved "State Plan;" therefore, OSHA enforces occupational safety and health regulations for the private sector in Rhode Island. Rhode Island has adopted OSHA safety and health standards by reference for public sector employers, with additional hazard communication and contractor training requirements. The Rhode Island Department of Health (RIDOH) regulates health and safety of the general public.

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C. Table 13.1.15-1 below summarizes the major Rhode Island laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 13.1.15-1: Relevant Rhode Island Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Rhode Island General Laws, Chapter 28-20, Division of Occupational Safety	RIDLT; Workforce Regulation and Safety; Occupational Safety Unit	Establishes the Occupational Safety Unit within RIDLT and authorizes the Occupational Safety Unit to administer and enforce occupational safety and health rules in public sector workplaces.
Rhode Island General Laws, Chapter 28-21, Hazardous Substances Right-to-Know Act	RIDLT; Workforce Regulation and Safety; Occupational Safety Unit	Requires employers who use, transport, store, or expose its employees to toxic or hazardous substances to maintain a list of all hazardous substances and allow employees access to this list. Specifies employee training, labeling, and recordkeeping requirements. Requires employers to provide the local fire department with a list of work areas where hazardous or toxic substances are present.

State Law/Regulation	Regulatory Agency	Applicability
Rhode Island General Laws, Chapter 5-70, Telecommunications	RIDLT; Workforce Regulation and Safety; Professional Regulation Unit	Specifies requirements for certification and licensing of telecommunication system contractors and installers to protect public interests, assure compliance with standards, and promote safe practices.
RIDEM, Regulation #DEM OWM-SW04-01, Solid Waste Regulations	RIDEM; Bureau of Environmental Protection; Office of Waste Management	Provides operating requirements for solid waste management facilities including solid waste landfills, transfer and collection stations, incinerators and resource recovery facilities, waste tire storage and recycling facilities, petroleum-contaminated soil processing facilities, facilities that process construction and demolition debris, and composting facilities.
RIDEM, Regulation #DEM OWM-HW 01-14, Hazardous Waste Regulations	RIDEM; Bureau of Environmental Protection; Office of Waste Management	Specifies requirements for hazardous waste treatment, storage, and disposal facilities, universal waste, and used oil management.
RIDEM, Regulation #DEM-DSR-01-93, Remediation Regulations	RIDEM; Bureau of Environmental Protection; Office of Waste Management	Specifies requirements for the investigation, assessment, and remediation of contaminated sites to protect human health and the environment.
Rhode Island General Laws, Chapter 23-19.11, Low-Level Radioactive Waste Disposal	RIDEM; Bureau of Environmental Protection; Office of Waste Management	Provides for the disposal of all low-level radioactive waste (LLRW) generated in the state under a regional low-level waste management compact at a regional disposal facility, as authorized by the LLRW Management Act of 1986.

13.1.15.3. Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over water bodies, and on communication towers. Tasks are often performed at dangerous heights, 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.

Health and Safety Hazards

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 – Installation of underground utilities, building foundations, and work in utility manholes[117] 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 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 (e.g., manholes) present 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 13.1.13, Noise) (OSHA, 2002). Fugitive

[117] 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.

noise may emanate beyond the telecommunication work site and affect 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 (exterior and interior) paint at outdoor structures or asbestos tiles and insulation in equipment sheds. The general public, unless a telecommunication work site allows unrestricted access, are typically shielded from hazardous materials and hazardous wastes that are components of telecommunication site work. (OSHA, 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, and other unstable surfaces. There is potential for equipment and personnel falls, as well as drowning in water bodies. 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)

13.1.15.4. Telecommunication Worker Occupational Health and Safety

The 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), and 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, Rhode Island employed 580 telecommunication line installation and repair workers, and 610 telecommunication equipment installers and repairers (BLS, 2015c). In 2007, the most data available[118], Rhode Island reported 1.9 nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2007). By comparison, 2.5 nonfatal occupational injuries or illnesses were reported nationwide per 100 full-time workers in the telecommunications industry in 2007 (BLS, 2008). 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, 2013). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of total occupational fatalities (4,585 total). Rhode Island has not reported fatalities in the telecommunications industry or telecommunications occupations since 2003, when data are first available (BLS, 2015d).

Public Health and Safety

The general public are not likely to encounter occupational hazards at telecommunication sites, due to limited access. Rhode Island has not recorded incidents of injuries from the public to these sites. Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

13.1.15.5. 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.

[118] BLS Survey of Occupational Injuries and Illnesses data are not available for Rhode Island for 2008 to 2011.

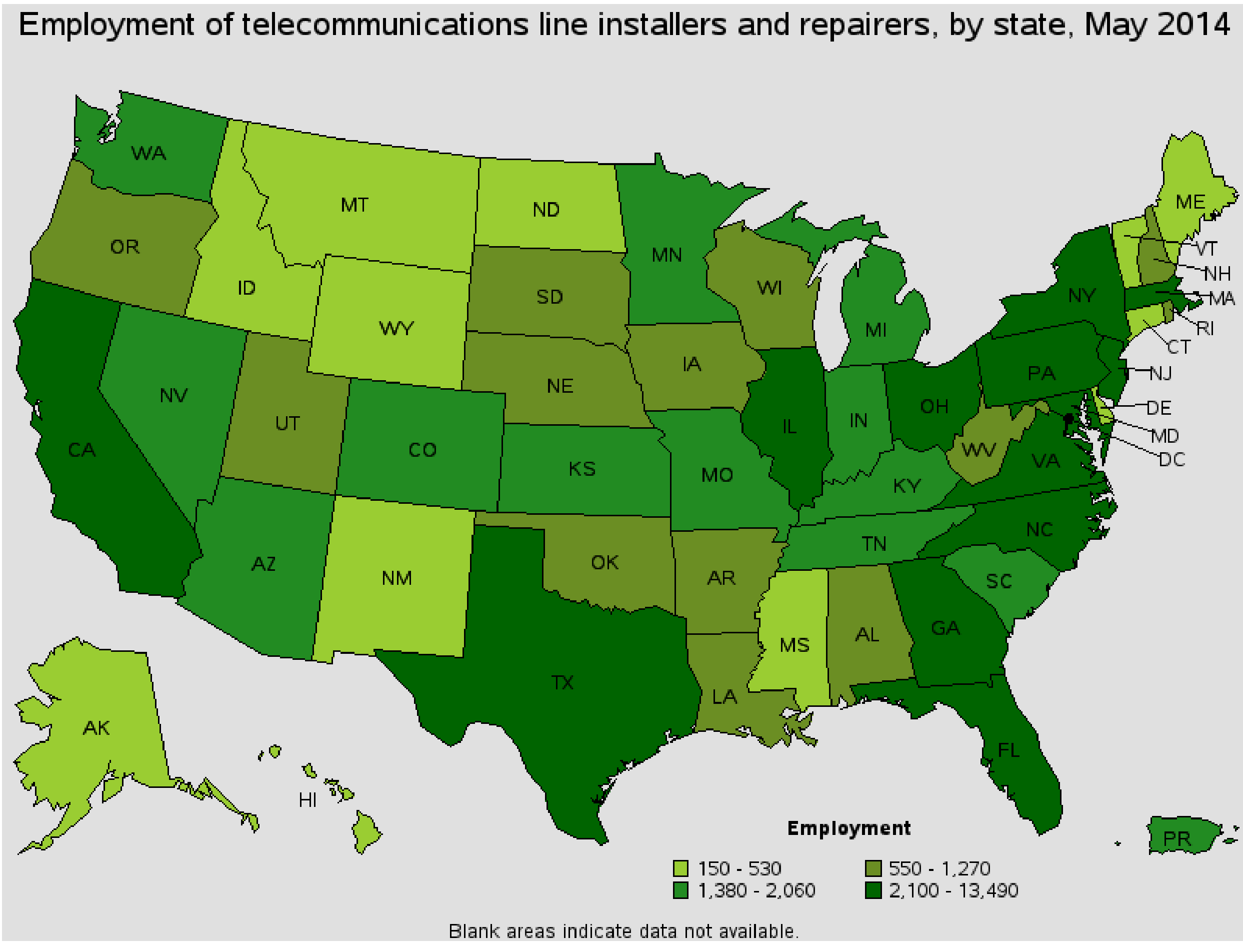

Figure 13.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015b)

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[119] 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.

In Rhode Island, the state Superfund and DoD Program administers the remediation of state and federal NPL sites, including currently and formally used DoD sites. Under this program,

[119] 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, 2011b)

RIDEM also conducts investigations and evaluations of suspected hazardous waste sites to determine whether a site should be listed on the NPL for cleanup under Superfund. (RIDEM, 2015r) As of September 2015, Rhode Island had 12 RCRA Corrective Action sites[120], 305 brownfield sites, and 12 proposed or final Superfund/NPL sites (USEPA, 2013d). Based on a September 2015 search of USEPA's Cleanups in My Community (CIMC) database, Rhode Island has one Superfund site where contamination was detected at an unsafe level, or a reasonable human exposure risk exists (Centredale Manor Restoration Project in Providence County) (USEPA, 2015n). The RIDEM Site Remediation and Brownfields Programs are used to identify, investigate, and cleanup non-NPL sites as an alternative to federal programs (RIDEM, 2015s). RIDEM has state-specific soil and groundwater cleanup objectives and applies them to cleanups with consideration to current and anticipated future use of the contaminated site. Contaminated sites that meet state cleanup requirements may be reused and redeveloped in Rhode Island communities. (RIDEM, 2011d)

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 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, Rhode Island had 92 TRI reporting facilities. According to the USEPA[121], in 2013, the most recent data available, Rhode Island released 302,326 pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from the fabricated metals and chemical manufacturing industries. This accounted for 0.01 percent of total nationwide TRI releases, ranking Rhode Island 48 of 56 states and territories based on total releases per square mile. (USEPA, 2014g)

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment.

The National Institute 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" (NIH, 2015a). Figure 13.1.15-2 provides an overview of potentially hazardous sites in Rhode Island.

[120] Data gathered using USEPA's Cleanups in My Community (CIMC) search on September 14, 2015, for all sites in Rhode Island, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active). (USEPA, 2013d)

[121] Note that submission of a TRI Report does not necessarily indicate a spill or release to the environment.

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over water bodies. Indoor air quality may be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. RIDEM has not reported any statistics relating to occupational exposure from environmental contamination. According to BLS, Rhode Island had no occupational fatalities within the telecommunications industry since 2003, when data are first available; therefore, no fatalities resulted from exposure to harmful substances or environments. By comparison, there were three reported fatalities in 2011 and three "preliminary" fatalities[122] in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (BLS, 2015e). In 2014, BLS also reported four "preliminary" 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, 2014).

In addition to hazardous waste contamination, another health and safety hazard includes surface and subterranean mines. Health and safety hazards known to be present 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 (Federal Mining Dialogue, 2015a). Gradual settling or sudden sinking of the Earth's surface, also known as subsidence, presents additional risks and is further discussed in Section 13.1.3, Geology. As of May 2015, there were no high priority AMLs (sites posing health and safety hazards) in Rhode Island (USDOI, Office of Surface Mining Reclamation and Enforcement, 2015).

[122] 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, 2015f).

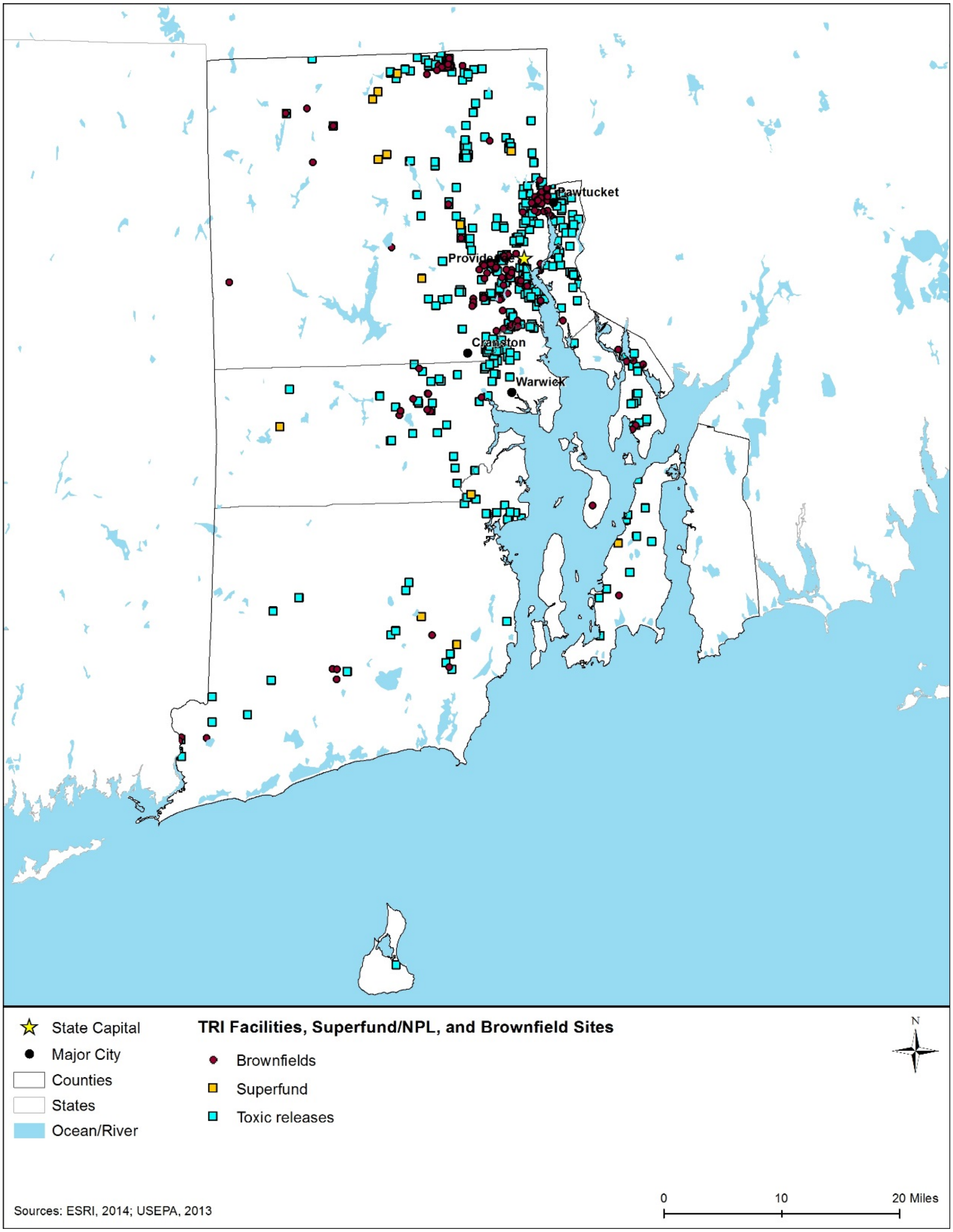

Figure 13.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Rhode Island (2013)

Source: (NIH, 2015b)

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. RIDOH is responsible for collecting public health data resulting from exposure to environmental contamination. No data are available from the state of Rhode Island indicating public exposure to environmental hazards at contaminated sites, including telecommunications sites, resulted in public illnesses or fatalities (Rhode Island Department of Health, 2015a). According to the U.S. Center for Disease Control and Prevention, National Environmental Public Health Tracking Network Reporting Tool, the rate of injuries and fatalities due to reported acute toxic substance release incidents in Rhode Island varies year to year between 1 and 6 incidents per 100,000 population, with the highest incidence year being 2001 (CDC, 2016).

13.1.15.6. Environmental Setting: Natural and 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.

Spotlight on Rhode Island Superfund Sites: Centredale Manor Restoration Project

The Centredale Manor Restoration Project Superfund site includes a 9-acre main site area and an area extending down the Woonasquatucket River, to the Allendale Dam and further to the Lyman Mill Dam, in North Providence, RI. Prior to 1936, the site was a wool mill. Between 1943 and 1972, a chemical manufacturing company and drum reconditioning facility operated on the main site area until a fire destroyed many of the industrial facilities. Since 1977, the site has been occupied by the Brook Village and Centredale Manor apartment complexes (constructed in 1977 and 1982, respectively).

In 1996, dioxin was detected in fish samples collected from the Woonasquatucket River. Additional investigations found elevated concentrations of dioxin/furans, PCBs, pesticides, volatile organic compounds (VOCs), semi-VOCs, and metals in soil, sediment, groundwater and surface water at the site, posing public health risks to nearby residences along the Woonasquatucket River (USEPA, 2015o). Potential future carcinogenic risks exist for construction workers at the main site area from exposure to surface soil via ingestion and dermal contact. Similar risks to the general public (e.g., recreational visitors) are also present in the Lyman Mill Dam and Allendale Dam areas of the site. (USEPA, 2014a)

Centredale Manor Restoration Superfund Site

Source: (USEPA, 2015o)

From 1999 to 2014, USEPA implemented mitigation measures to reduce immediate threats to public health and the environment, including fencing, contaminated soil removal at the Centredale Manor and Brook Village properties, capping source areas of contamination, removing highly contaminated floodplain soil from residential areas along the river, and reconstructing Allendale Dam. USEPA's 2012 final remedy selection would install a permanent cap over main site area contamination and excavate a large quantity of contaminated material to prevent future human exposures. (USEPA, 2015o)

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, the RIDLT 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. Such incidents present unique, hazardous challenges to telecommunication workers responding during natural disasters.

Public Health and Safety

Hazards present during natural and manmade disasters are often ubiquitous, affecting large geographic areas and affecting all populations living within the area. Similar to telecommunication workers, the general public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities, potential for exposure to unknown chemical and biologic hazards, and inadequate medical support. In 2014, Rhode Island experienced one weather-related fatality and no injuries (NWS, 2015). In contrast, Rhode Island had five weather-related fatalities in 2008 (the greatest number of fatalities in the past 10 years), one from lightening and two from extreme heat. No data were available regarding the cause of the other three fatalities in 2008. (National Climatic Data Center, 2009).

Spotlight on Rhode Island Natural Disaster Sites: Hurricane Irene, August 2011

During Hurricane Irene, Rhode Island experienced a storm surge of 2 to 4.8 feet along the coast, coastal and localized river flooding, and high winds (USDOC, 2013c). Sustained winds lasting up to 12 hours uprooted trees, damaging power lines and leaving half a million Rhode Island residents without power for up to seven days. Property damages from winds totaled $0.19M. (NWS, 2011b). Nationwide, Hurricane Irene caused over 40 fatalities and $6.5 billion in property damage (USDOC, 2013c).

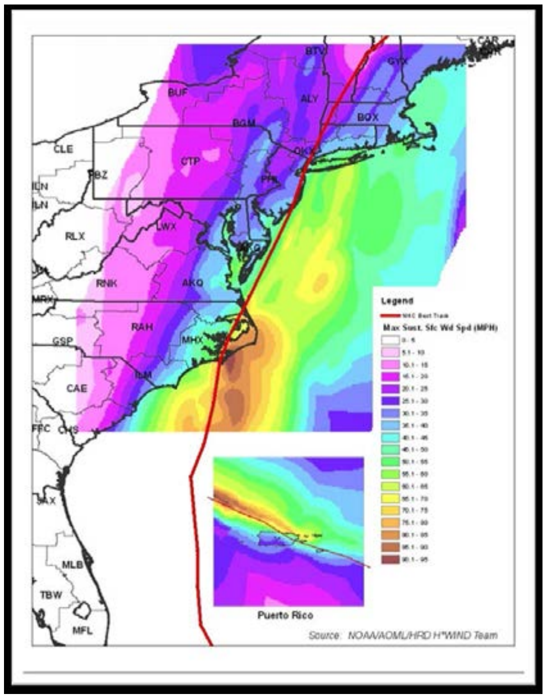

Figure 11.9.5-1: Surface Wind Speed during Hurricane Irene

Source: *(USDOC, 2013c)*

Rhode Island also experienced unique challenges to its healthcare system from Hurricane Irene, specifically, power outages and evacuations at three nursing homes and one low-income elderly housing complex. Generators used during the outages failed hours into the storm. However, through prioritization from the National Grid, assistance from emergency management agencies, and Hospital Preparedness Program funding for interoperable communications, working generators were relocated around the state, preventing another nine nursing home and assisting living facility evacuations. (U.S. Department of Health & Human Services, Office of the Assistant Secretary for Preparedness and Response, 2012)

13.2. Environmental Consequences

13.2.1. Infrastructure

13.2.1.1. Introduction

This section describes potential impacts to infrastructure in Rhode Island associated with construction, deployment, and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 13.2.1-1. As described in Section 13.2, 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 13.2.1-1: Impact Significance Rating Criteria for Infrastructure

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Transportation system capacity and safety	Magnitude or Intensity	Creation of substantial traffic congestion/delay and/or a substantial increase in transportation incidents (e.g., crashes, derailments)	Effect that is potentially significant, but with mitigation is less than significant	Minimal change in traffic congestion/delay and/or transportation incidents (e.g., crashes, derailments)	No effect on traffic congestion or delay, or transportation incidents
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Persisting indefinitely		Short-term effects will be noticeable for up to the entire construction phase or a portion of the operational phase	NA
Capacity of local health, public safety, and emergency response services	Magnitude or Intensity	Impacted individuals or communities cannot access health care and/or emergency services, or access is delayed, due to the project activities	Effect is potentially significant, but with mitigation is less than significant	Minor delays to access to care and emergency services that do not impact health outcomes	No impacts on access to care or emergency services
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state)		Impacts only at a local/neighborhood level	NA
	Duration or Frequency	Duration is constant during construction and deployment phase		Rare event during construction and deployment phase	NA

Type of Effect	**Effect Characteristics**	**Impact Level**			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Modifies existing public safety response, physical infrastructure, telecommunication practices, or level of service in a manner that directly affects public safety communication capabilities and response times	Magnitude or Intensity	Substantial adverse changes in public safety response times and the ability to communicate effectively with and between public safety entities	Effect that is potentially significant, but with mitigation is less than significant	Minimal change in the ability to communicate with and between public safety entities	No perceptible change in existing response times or the ability to communicate with and between public safety entities
	Geographic Extent	local/city, county/region, or state/territory		local/city, county/region, or state/territory	local/city, county/region, or state/territory
	Duration or Frequency	Permanent or perpetual change in emergency response times and level of service		Change in communication and/or the level of service is perceptible but reasonable to maintaining effectiveness and quality of service	NA
Effects to commercial telecommunication systems, communications, or level of service	Magnitude or Intensity	Substantial adverse changes in level service and communications capabilities	Effect that is potentially significant, but with mitigation is less than significant	Minor changes in level of service and communications while transitioning to the new system	No perceptible effect to level of service or communications while transitioning to the new system
	Geographic Extent	local/city, county/region, or state/territory		local/city, county/region, or state/territory	local/city, county/region, or state/territory
	Duration or Frequency	Persistent, long-term, or permanent effects to communications and level of service		Minimal effects to level of service or communications lasting no more than a short period (minutes to hours) during the construction and deployment phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to utilities, including electric power transmission facilities and water and sewer facilities	Magnitude or Intensity	Substantial disruptions in the delivery of electric power or to physical infrastructure that results in disruptions, including frequent power outages or drops in voltage in the electrical power supply system ("brownouts"). Disruption in water delivery or sewer capacity, or damage to or interference with physical plant facilities that impact delivery of water or sewer systems	Effect that is potentially significant, but with mitigation is less than significant	Minor disruptions to the delivery of electric power, water, and sewer services, or minor modifications to physical infrastructure that result in minor disruptions to delivery of power, water, and sewer services	There would be no perceptible impacts to delivery of other utilities and no service disruptions.
	Geographic Extent	local/city, county/region, or state/territory		local/city, county/region, or state/territory	local/city, county/region, or state/territory
	Duration or Frequency	Effects to other utilities would be seen throughout the entire construction phase		Effects to other utilities would be of short duration (minutes to hours) and would occur sporadically during the entire construction phase	NA

NA = not applicable

13.2.1.3. 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 deployment phases of specific projects. 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. Based on the impact significance criteria presented in Table 13.2.1-1, such impacts would be less than significant due to the temporary nature of the deployment activities, even if such impacts would be realized at one or more isolated locations. Such 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 – and that is 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 first responders 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 13.2.1-1, such potential negative and positive impacts would be less than significant.

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 13.2.1-1, any potential impacts would be less than significant during deployment. As described above, during deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to compliment such practices and SOPs in a positive manner; therefore, only beneficial or complimentary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience such beneficial impacts through enhance communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus such 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.

Effects to Commercial Telecommunication Systems, Communications, or Level of Service

Commercial telecommunication systems, communications, or level of service would experience no impacts, as such commercial assets would be using a different spectrum for communications. 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.[123] Such leases would then have less than significant positive impacts on commercial telecommunication systems, communications, or level of service, per the impact significance criteria presented in Table 13.2.1-1.

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 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.

13.2.1.4. 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.

[123] 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.

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 (POPs)124, huts, or other associated facilities or hand-holes125 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 replacement of existing telecommunications poles.
  - Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland 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 shore to accept 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 can enhance public safety

[124] Points of Presence are connections or access points between two different networks, or different components of one network.
[125] A small hole typically large enough for one to insert a hand and arm into for inspection and maintenance activities.

infrastructure, and other telecommunications as the site could potentially be available for subsequent collocation.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would result in localized impacts to that tower and such as minor disruptions in services. As a result of collocation of equipment, the potential addition of power units, structural hardening, and physical security measures could potentially have beneficial impacts on existing infrastructure assets, depending on the site specific plans.
- Deployable Technologies: Deployable technologies such as COWs, COLTs, and SOWs are 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-in to the electric grid. These impacts are expected to be less than significant 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. See Chapter 17, BMPs and Mitigation Measures, for 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.

- Positive impacts to infrastructure resources may result from the expansion of public safety and commercial telecommunications capacity and an improvement in public safety telecommunications coverage, system resiliency, response times, and system redundancy.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off 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.

13.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[126]

Deployable Technologies Alternative

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for

[126] As mentioned above and in Section 2.1.3, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

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 result as explained above, although these potential impacts would be expected to be minor and temporary.

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.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try and avoid any negative impacts to such resources. Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access road or utility ROW, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts would likely still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables.

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 13.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

13.2.2. Soils

13.2.2.1. Introduction

This section describes potential impacts to soil resources in Rhode Island associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 13.2.2-1. As described in Section 13.2, 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.

13.2.2.3. Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern of 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 Rhode Island and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment can impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Areas exist in Rhode Island that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Aquepts and Udepts (see Section 13.1.2.4, Soil Suborders and Figure 13.1.2-2).

Table 13.2.2-1: Impact Significance Rating Criteria for Soils

Type of Effect	Effect Characteristic	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

Based on the impact significance criteria presented in Table 13.2.2-1, building 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.

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 13.2.2-1, 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 17), 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 13.1.2.3, Soil Suborders). Heavy equipment can cause perceptible compaction and rutting of susceptible soils, particularly if BMPs and mitigation measures are not implemented, however this is not anticipated, based on the limited extent of susceptible soils, as described below.

Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 13.1.2.4, Soil Suborders). The most compaction susceptible soils in Rhode Island are hydric soils with poor drainage conditions, which include Aquepts. Aquepts are found in approximately two percent of Rhode Island[127], found mostly in northern and eastern areas of the state (seeFigure 13.1.2-2). 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 13.2.2-1, 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.

13.2.2.4. 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 13.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical

[127] This percentage was calculated by dividing the acres of soils that fall within the suborders listed above by the total soil land cover for the state.

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 13.1.2, 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 require any ground disturbing activity.
  - 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 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 would be expected to be less than significant as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way for deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. 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. The impacts are expected to be less than significant due to the temporary nature and small-scale of operations activities with the potential to create impacts. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.2.5. Alternatives Impact Assessment

The following section assesses potential impacts to soils associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to soil resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to soil resources if 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 due to the small-scale and short term nature of the deployment. Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to soil resources associated with routine inspections of the deployable assets, 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 the acceptable load of the surface is exceeded, less than significant soil compaction and rutting impacts could result as previously explained above. Finally, if deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in minimal soil erosion. However, it is anticipated that the potential soil erosion would result in less than significant impacts as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to soil resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 13.1.2, Soils.

13.2.3. Geology

13.2.3.1. Introduction

This section describes potential impacts to Connecticut geology resources associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 13.2.3-1. As described in Section 13.2, 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.

Table 13.2.3-1: Impact Significance Rating Criteria for Geology

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs 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 BMPs 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
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
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.

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	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

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.

13.2.3.3. 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 and landslides, and those that would be impacts from the project, such as land subsidence, 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 13.1.8.3, the majority of Rhode Island is not at risk to severe earthquake events. As shown in Figure 13.1.3-4, all of Rhode Island is at risk to minor earthquakes; no earthquake over magnitude 4.0 on the Richter scale has been recorded in the state. Based on the impact significance criteria presented in Table 13.2.3-1, seismic impacts would be less than significant if FirstNet's deployment locations were within high-risk earthquake hazard zones or active fault zones; however, seismic impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within high-risk earthquake hazard 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 earthquakes in Rhode Island, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and Mitigation Measures (see Chapter 17), could help avoid or minimize potential impacts.

Landslides

As discussed in Section 13.1.3.8, Rhode Island is at low risk of experiencing landslide events. Coastal portions of Block Island (off the southern coast of the state) are susceptible to slope failure. Based on the impact significance criteria presented in Table 13.2.3-1, potential impacts 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. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts in cases where equipment is deployed in landslide-prone areas.

Land Subsidence

As discussed in Section 13.1.8, portions of coastal Rhode Island are vulnerable to land subsidence due in coastal areas. Based on the impact significance criteria presented in Table 13.2.3-1, 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 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[128] and inundation of equipment. All of these activities could result in connectivity loss. To the extent practicable, FirstNet would attempt to avoid deployment in known areas where coastal land subsidence could result in inundation of equipment. However, given that several of Rhode Island's major cities are along the coast and may be susceptible to sea level rise, some amount of infrastructure may subject to subsidence hazards, in which case BMPs and mitigation measures, as discussed in see Chapter 17, could help avoid or minimize the potential impacts.

Mineral and Fossil Fuel Resource Impacts

As discussed in Section 12.1.3.7 and shown in Figure 12.1.3-4, portions of Rhode Island contain mineral and fossil fuel resources. Equipment deployment near mineral and fossil fuel resources are 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 13.2.3-1, impacts to mineral and fossil fuel resources are 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.

Paleontological Resource Impacts

Equipment installation and construction activities that require ground disturbance could damage existing paleontological resources, which are both fragile and irreplaceable. As discussed in Section 13.1.3.7, fossils occur in parts of Rhode Island, including the Narragansett Basin. 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 13.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. It is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized. Potential impacts to fossil resources should be

[128] Relative Sea Level Rise: "Relative Sea Level Trends reflect changes in local sea level over time and are typically the most critical sea level trend for many coastal applications, including coastal mapping, marine boundary delineation, coastal zone management, coastal engineering, sustainable habitat restoration design, and the general public enjoying their favorite beach." (NOAA, 2016)

considered on a site-by-site basis, and BMPs and mitigation measures (see Chapter 17) could further help avoid or minimize the 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 13.2.3-1, 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 (see Chapter 17) could be implemented to help avoid or minimize the potential impacts.

13.2.3.4. 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 resources and paleontological resources. The types of infrastructure 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 points of presence POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to 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 hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water is not expected to impact geologic resources 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 perturbation 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 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 include minimal 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. These potential impacts are expected to be less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Operation Impacts

As described in Section 13.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to geology associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections.

The operation of the Preferred 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 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. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.3.5. 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 due to the minor amount of paving or new infrastructure needed to accommodate the deployables. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to geologic resources (or from geologic hazards) associated with routine inspections of the Preferred Alternative.

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 as the deployment would be temporary and likely would attempt to avoid locations that was subject to increased seismic activity, landslides, and land subsidence. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs an d mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to geologic resources (or from geologic hazards) as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 13.1.3, Geology.

13.2.4. Water Resources

13.2.4.1. Introduction

This section describes potential impacts to water resources in Rhode Island associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 13.2.4-1. As described in Section 13.2, 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 13.2.4-1: 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		The impact is temporary, lasting no more than six months.	NA
Floodplain degradation*	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is potentially significant, but with mitigation is less than significant.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.

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	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		The 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		The 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
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent		Impact is temporary, not lasting more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
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		Potential impact is temporary, not lasting more than six months.	NA

* - 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).
NA = not applicable

13.2.4.3. 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.

According to the USEPA, approximately half of Rhode Island's surface waterbodies are impaired (see Figure 13.1.4-2). None of Rhode Island's coastal shoreline waters are impaired. (USEPA, 2015b) Generally, the water quality of Rhode Island's aquifers is suitable for drinking and most uses.

Deployment activities can contribute pollutants in a number of ways but the primary manner is increased sediment in surface waters. Vegetation removal on site exposes soils to rain and wind that can 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 can contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, pH or dissolved oxygen levels, water odor, color, or taste, or addition of suspended solids.

Soil erosion or the introduction of suspended solids into waterways from implementation of the Preferred Alternative could contribute to degradation of water quality. If the Proposed Action and Alternatives would disturb more than 1 acre of soil, a state or USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent keep 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, contaminated 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, and Safe Drinking Water Act), and local regulations, cause a threat to the human environment, biodiversity, or ecological integrity through water degradation, or cause a sediment water quality violation from local construction, or otherwise substantially degrade water quality.

Therefore, based on the impact significance criteria presented in Table 13.2.4-1, 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[129] 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 Rhode Island dewatering requirements. Any groundwater extracted during dewatering activities or as required by a dewatering permit would be treated prior to discharge or disposed of at a wastewater treatment facility.

Although this is extremely unlikely to occur, groundwater in Rhode Island is vulnerable to contamination because of the unconfined conditions of the aquifers and the high water table (typically less than 20 feet beneath ground surface) (Johnston & Barlow, 1987). Due to the nature of Rhode Island's aquifers, there is potential for impact from proposed deployment activities. It is not expected that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially and measurably degrade groundwater quality or aquifer characteristics, and based on the impact significance criteria presented in Table 13.2.4-1, 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.

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on humans, 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 13.2.4-1, 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 occur inside the 500-year floodplain, 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

[129] 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).

deployed in response to an emergency. Additionally, any effects would be temporary, lasting no more than one season or water year,[130] or occur only during an emergency.

Implementation of BMPs and mitigation measures could reduce the risk of additional impacts to floodplain degradation (see Chapter 17).

Drainage Pattern Alteration

Flooding and erosion from land disturbance can changes drainage patterns. Storm water runoff causes erosion while construction activities and land clearing can change drainage patterns. Clearing or grading activities, or the creation of walls or berms can alter water flow in an area or cause changes to drainage patterns. Drainage can be directed to storm water drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage can cause increased erosion, changes in storm water runoff, flooding, and damage to water quality. Existing drainage patterns can be modified by channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); storm water increases; or altered flow patterns.

According to the significance criteria in Table 13.2.4-1, 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.

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, and avoidance 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 can 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 can 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 13.2.4-1. Projects that include minor consumptive use of surface water with less than significant impacts on discharge (do not direct large volumes

[130] 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, 2014j)

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 off site or into surface water bodies that have not received that volume of storm water before.
- 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 13.1.4.7, approximately 26 percent of Rhode Island's population, or two-thirds of municipalities in Rhode Island, depend on groundwater for drinking water supply. Generally, the water quality of Rhode Island's aquifers is suitable for drinking and most uses, and over 90 percent of the state's groundwater can be used for drinking water without requiring treatment. (RIDEM, 2015t) Groundwater is an important natural resource used by industrial, commercial, agricultural, and residential uses for manufacturing, irrigation, and drinking water purposes. 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 unlikely cause any impacts to water quality. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation 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.
- Commercial generation, treatment, storage, or disposal of hazardous wastes.
- 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 are expected to 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 13.2.4-1, 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.

13.2.4.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, 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 , attached to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to marine and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids

running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to water resources.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Deployable Technologies: Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in 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; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts, but are expected to be less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure would likely be less than significant due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is complete. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 13.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along exiting roads and utility rights-of way. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected.

13.2.4.5. 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 the deployment occurred on paved surfaces if there is any runoff into the surface water. 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. The amount of impact depends on the land area affected, installation technique, and location. Implementing the BMPs and mitigation measures identified in Chapter 17 could further avoid or reduce potential impacts. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 13.1.2, 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 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. Site maintenance, including mowing or herbicides, may result in less than significant effects to water quality, due to the small-scale of expected FirstNet activities in any particular location, depending on the location and amount of herbicides used. 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.

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 13.1.4, Water Resources.

13.2.5. Wetlands

13.2.5.1. Introduction

This section describes potential impacts to wetlands in Rhode Island associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 13.2.5-1. As described in Section 13.2, 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 13.2.5-1: 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 degradation (spills or sedimentation)	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA

	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA
Indirect effects: [b] change in function(s)[c] change in wetland type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.)	Effect that is potentially significant, but with mitigation is less than significant	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No changes in wetland function or type
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA
	Duration or Frequency	Long-term or permanent		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA

[a] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories (USACE 2014). Category 1 are the highest quality, highest functioning wetlands
[b] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type
[c] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

13.2.5.3. 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. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

There are approximately 70,000 acres of wetlands throughout Rhode Island (USFWS, 2014). Palustrine (freshwater) wetlands are found on river and lake floodplains across the state, and estuarine/marine (tidal) wetlands are present along the Atlantic Coast and Narragansett Bay, as shown in Figure 13.1.5-1.

Based on the impact significance criteria presented in Table 13.2.4-1, and given the temporary nature of most proposed activities, the deployment activities would most likely have less than significant direct impacts on wetlands.

In Rhode Island, as discussed in Section 13.1.5.4, Wetlands, regulated high quality wetlands include “special aquatic sites” (e.g., vernal pools), and wetlands associated with the Narragansett Bay NERR. In Rhode Island, vernal pools of all sizes are protected under the Freshwater Wetlands Act, and are referred to as “special aquatic sites.” Vernal pools will fill up with water in the spring and fall, with some found in wetlands such as red maple swamps, and others are isolated woodland depressions, and by mid-summer they typically dry up as they lack a permanent water source. Vernal pools provide important habitat for wildlife, including spotted salamanders, marbled salamanders, and wood frogs. (RIDEM, 2015i)

The Narragansett Bay NERR includes approximately 4,300 acres of upland, aquatic, and estuarine habitat in the Narragansett Bay including freshwater and coastal wetlands. The shoreline has many narrow cobble beaches, and fringe and meadow salt marshes are found in low energy, depositional areas. Costal wetland restoration efforts in the Bay are ongoing, and include protection of eelgrass beds and saltmarsh habitat. (NOAA, 2015c)

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.

Potential Other Direct Effects

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, 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 storm water discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 13.2.5-1, 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. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

Examples of activities that could have other direct effects to wetlands in Rhode Island 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 storm water runoff in wetlands can 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 Soil Changes:* Changes in soil chemistry can lead to degradation of wetlands that have a specific pH range and/or other parameter, such as the acidic conditions of sphagnum bogs and alkaline conditions of calcareous fens (which are high quality wetlands in Rhode Island).
- *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) can reduce light penetration, dissolved oxygen, and overall wetland productivity. Toxic materials in runoff can interfere with the biological processes of wetland plants, resulting in impaired growth, mortality, and changes in plant communities.

Indirect effects:[131] Change in Function(s)[132] 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 can 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. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

Examples of functions related to wetlands in Rhode Island 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 can lower flood peaks by providing detention of storm flows.
- *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 can eventually threaten a wetland's existence. Where sediment inputs exceed rates of sediment export and soil consolidation, a wetland would gradually become filled.
- *Nutrient Processing:* Wetland forests retain ammonia during seasonal flooding. Wetlands absorb metals in the soils and by plant uptake via the roots. They also allow metabolism of oxygen-deman ding 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 can harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes can have impacts on the preferred food supply and animal cover.

[131] 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

[132] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

- *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 13.2.5-1, 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 wetlands in Rhode Island 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.

In areas where high quality occur, there could be potentially significant impacts at the project level that would be analyzed on a case-by-case basis. If avoidance were not possible, BMPs and mitigation measures would help to mitigate impacts.

13.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations would be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wetlands and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to wetlands under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launches for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact on wetlands.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments, including coastal and marine environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.

- Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if 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, blimps, or piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (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 due to the small about 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing potential other direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are expected to be less than significant due to the limited nature of deployment activities. It is also anticipated that routine maintenance activities would be conducted on existing roads and utility ROW. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

13.2.5.5. Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wetlands as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be less than significant due to the small-scale and temporary duration of expected FirstNet deployment activities in any one location. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further 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 associated with routine inspections of the Deployable Technologies Alternative as it is likely existing roads and utility rights-of-way would be utilized for maintenance and inspection activities. Site maintenance, including mowing or herbicides, may is anticipated to result in less than significant effects to wetlands due to the limited nature of site maintenance activities, including mowing and application of herbicides.

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 13.1.5, Wetlands.

13.2.6. Biological Resources

13.2.6.1. Introduction

This section describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Rhode Island associated with deployment and operation of the Proposed Action and its alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.6.2. 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 13.2.6-1. As described in Section 13.2, 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 13.2.6.3, 13.2.6.4, and 13.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 13.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Rhode Island.

Table 13.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury/mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including: Marine Mammal Protection Act (MMPA), Magnuson Stevens Fishery Conservation And Management Act (MSFCMA), MBTA, and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is potentially significant, but with mitigation 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 Rhode Island for at least one species. Anthropogenic 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 Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation 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 Rhode Island 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 Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances, 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 mitigation 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 Rhode Island 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 Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long term loss of migratory pattern/path, or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation 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 Rhode Island for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success.
	Geographic Extent	Regional effects observed within Rhode Island for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning, or anthropogenic disturbances that lead to stress, abandonment and loss of productivity for endemics or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated or short-term effects that are reversed within one breeding season.	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with mitigation 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 Rhode Island.		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

NA= Not Applicable

13.2.6.3. Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in Rhode Island 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 13.2.6-1, 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, these events are expected to be relatively small in scale. The implementation of BMPs and mitigation measures and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations 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.

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. Further, if proposed sites with sensitive or rare regional vegetative communities are unavoidable, BMPs and mitigation measures would be recommended to minimize or avoid 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 can include stress related to disturbance. The alteration of soils or hydrology within a localized area can 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. Increasing or decreasing hydrology in an area as an indirect effect, could lead to moisture stress and/or mortality of plant species that are adapted to specific hydrologic regimes. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment, though BMPs and mitigation measures could help to minimize or avoid the potential impacts.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for terrestrial vegetation (e.g., forest migration) are expected as a result of the Proposed Action given the small-scale of deployment activities.

Reproductive Effects

No reproductive effects to terrestrial vegetation are expected as a result of the Proposed Action given the small-scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species can have a dramatic effect on natural resources and biodiversity.

When non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. Natural or native community species evolve together into an ecosystem with many checks and balances that limit the population growth of any one species. These checks and balances include such things as: predators, herbivores, diseases, parasites, and other organisms competing for the same resources and limiting environmental factors. However, when an organism is introduced into an ecosystem in which it did not evolve naturally, those limits may not exist and its numbers can sometimes dramatically increase. The unnaturally large population numbers can then have severe impacts to the environment, local economy, and human health. Invasive species can out-compete the native species for food and habitats and sometimes even cause their extinction. Even if natives are not completely eliminated, the ecosystem often becomes much less diverse (USFWS, 2012).

The potential to introduce invasive plants within construction zones and during long-term site maintenance can 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 minimize or avoid the potential for introducing invasive plant 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 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, depending on the deployment scenario or site-specific conditions. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology[133], and the nature as well as the extent of the habitats affected.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to terrestrial vegetation under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not impact terrestrial vegetation because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have no impact on terrestrial vegetation.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of points of presence POPs, huts, or other associated facilities or hand-holes

[133] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

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 if BMPs and mitigation measures are not implemented.

- New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public right-of-ways (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 if BMPs and mitigation measures are not implemented.
- 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 and 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 if BMPs and mitigation measures are not implemented.
- 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, the vegetation loss, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers or Backhaul Equipment: 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 launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs.

In general, the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the vegetation affected. These impacts are expected to be less than significant due to the small-scale of expected deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in less than significant effects 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 due to the small-scale of expected activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to terrestrial vegetation associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to terrestrial vegetation as a result of implementation of this alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts 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. However, impacts are expected to remain less than significant due to the relatively small-scale of FirstNet activities at individual locations. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to terrestrial vegetation associated with routine operations and maintenance due to the relatively small-scale of likely FirstNet project sites. The impacts can vary greatly among species, vegetative community, and geographic region, but are expected to remain less than significant.

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 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 13.1.6.3, Terrestrial Vegetation.

13.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in Rhode Island and Rhode Island's near offshore environment (i.e., less than two miles from the edge of the coast) 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 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 13.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of the 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.

<u>Terrestrial Mammals</u>

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Rhode Island. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, preferred vegetation along roadways, areas of insect relief, and ease of travel along road corridors (FHWA, 2015). 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.

If bats, and particularly maternity colonies are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small-scale and would be dependent on the location and type of deployment activity, and the amount of tree removal. Site avoidance measures could be implemented to avoid disturbance to bats.

Marine Mammals

Marine mammals swimming or hauled out on land are sensitive to boats, aircraft, and human presence. Noises, smells, sounds, and sights may elicit a flight reaction. Trampling deaths associated with haulout disturbance are known source of mortality for seals but are not anticipated from likely FirstNet deployment activities.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and violate MBTA and BGEPA. Generally, collision events occur to “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 (Gehring, Kerlinger, & and Manville, 2011).

Avian mortalities or injuries can also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds can 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 nesting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, D. et al., 1997). Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small-scale of likely FirstNet actions.

Direct mortality and injury to birds of Rhode Island are not likely to be widespread or affect populations of species as a whole; individual species impacts may be realized depending on the nature of the deployment activity. If siting considerations and BMPs and mitigation measures are implemented (Chapter 17), potential impacts would be minimized. Additionally, potential impacts under MBTA and BGEPA can be addressed through BMPs and mitigation measures.

Reptiles and Amphibians

The majority of Rhode Island’s amphibian and reptile species are widely distributed throughout Rhode Island. Direct 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.

Four species of marine turtles – all listed as threatened or endangered under the ESA – occur in Rhode Island’s offshore environment. Environmental consequences pertaining to these reptiles are discussed in Section 13.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Rhode Island 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

Habitat impacts are primarily physical perturbations 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, and impeding access to resources and mates. There are areas of Rhode Island that have experienced extensive land use changes from urbanization and agriculture. However, there are also portions of the state that are forested and remain relatively unfragmented.

Additionally, habitat loss can 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.

Potential effects of vegetation and habitat loss, alteration, or fragmentation are described for Rhode Island's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Rhode Island and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals 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 that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures.

Marine Mammals

While a number of seal species may occur in the offshore areas of Rhode Island, sightings are rare with the exception of the harbor seal (*Phoca vitulina*). Harbor seals tend to be non-migratory; they can be found in open waters and also using rocks, beaches or other coastal habitats as haulouts and pupping sites in Rhode Island, particularly in the Long Island area. Although FirstNet activities are unlikely to occur in oceanic environments, seals could be temporarily excluded from a resource or abandon their haulout locations due to the presence of humans, noise, or vessel traffic during deployment activities. For example, the seals would need to find a new haulout, likely at a less favorable location. Effects on seals from exclusion from resources would be low magnitude and temporary in duration.

Further, whales may be temporarily excluded from a resource if they avoid it due to the increased presence of boats, humans, and associated noise. Depending on the duration of response activities, minke whales could be excluded from their environment temporarily or could abandon the habitat entirely. Both of these scenarios are highly unlikely given that FirstNet activities will not occur in oceanic environments.

The degree to which habitat exclusion affects minke whales depends on many factors. Minke whales are mobile and are found in open water habitat in both coastal inshore and offshore oceanic environments; therefore, it is expected that activities would have only a minor and temporary effect on the ability of minke whales to access important resources. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures, as appropriate.

Birds

The direct removal of any most bird nests structure are protected under the MBTA. The USFWS can provide regional guidance on the most critical time periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation can affect avian species directly by loss of nesting, foraging, stopover, and cover habitat.

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, D. et al., 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[134] 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 can have major impacts to species that migrate in large flocks and concentrate at stop overs (e.g., shorebirds). BMPs and mitigation measures, including nest avoidance during construction-related activities, could help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for Rhode Island's amphibians and reptiles typically consist of wetlands and, in some cases), the surrounding upland forest. Impacts are expected to be less than significant. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 17) would be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 13.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed

[134]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.

Action may also have effects to Rhode Island's amphibian and reptile populations, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.[135]

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 13.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

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 can include stress related to disturbance and disruption of life history patterns (e.g., migration and breeding) important for survival. A short-term stress response to an acute, temporary stressor, initiates a "fight or flight" response which diverts energy, otherwise used for reproduction and growth, to the immediate survival of the animal (*Reeder and Kramer 2005*). Most organisms are well adapted and recover quickly from these types of stressors. A chronic stress response to a persistent stressor, however, can be detrimental to the organism and result in cell death, compromised immune system, muscle wasting, reproductive suppression, and memory impairment (*Reeder and Kramer 2005*).

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Terrestrial Mammals

Stress from repeated disturbances during critical time periods (e.g., roosting and mating) can reduce the overall fitness and productivity of young and adult terrestrial mammals. Indirect effects could occur result 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, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Marine Mammals

Although FirstNet is unlikely to operate in oceanic environments, repeated disturbance (e.g., from vessel traffic), especially near haulouts, can cause stress to individuals resulting in lower fitness and productivity. Given that the majority of FirstNet deployment activities are not

[135] See Section 13.2.5, Wetlands, for a discussion of BMPs for wetlands.

expected to be located onshore 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, can 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, D. et al., 1997). The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, can cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Terrestrial Invertebrates

Terrestrial invertebrates can 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. Potential effects to migration patterns of Rhode Island's amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates are described below.

Terrestrial Mammals

Large game animals have well-defined migratory routes. Route knowledge is passed on from one generation to the next and includes important feeding and calving areas. Small mammals also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula[136]. 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 can vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

[136] A location chosen by an animal for hibernation.

Marine Mammals

Noise associated with the installation of cables in the nearshore waters of coastal Rhode Island 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[137]. It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. Marine mammals have the capacity to divert from sound sources during migration, though BMPs and mitigation measures would help to 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 vast distances often involving many different countries. For example, as a group, shorebirds migrating through Rhode Island undertake some of the longest-distance migrations of all animals. Rhode Island is located within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. Rhode Island has 18 IBAs throughout the state that serve as important stopover areas for migratory birds (*National Audubon Society Inc. 2015*). Many migratory routes are passed from one generation to the next. Impacts can 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 less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Reptiles and Amphibians

The wood frog and spring peeper are known to seasonally migrate in Rhode Island. These amphibians follow their migration pathway to reach vernal pools for breeding in the spring (RIDEM, 2016c). However, (Berven & Grudzien, 1990) found that a small percentage of juvenile wood frogs can migrate over 1.5 miles from natal ponds, suggesting juveniles may be capable of migrating relatively long distances. Mortality and barriers to movement could occur as result of the Proposed Action (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but and impacts are expected to be less than significant. BMPs and mitigation measures 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. No effects to migratory patterns of Rhode Island's terrestrial invertebrates are expected as a result of the Proposed Action.

[137] 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*)

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 can affect the overall population of individuals.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and calving grounds for large mammals, such as the moose, has the potential to negatively affect body condition and reproductive success of mammals in

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small-scale and impacts are expected to be less than significant. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

Marine Mammals

Although FirstNet is unlikely to operate in an oceanic environment, restricted access to important calving grounds has the potential to negatively affect body condition and reproductive success of marine mammals in Rhode Island. For example, the displacement of female seals from preferred pupping habitats due to deployment or operation activities may reduce fitness and survival of pups potentially affecting overall productivity, though activities are likely to be small-scale in nature, and BMPs and mitigation measures would help to avoid or minimize the potential impacts.

Disturbance to hauled out seals from activities associated with the Proposed Action could result in the abandonment, or death of offspring, though BMPs and mitigation measures would 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, D. et al., 1997). The majority of FirstNet deployment or operation activities are likely to be small-scale in nature. BMPs and mitigation measures as defined through consultation with USFWS, if required, could help to avoid or minimize any potential impacts.

Reptiles and Amphibians

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests. For example, the spotted turtle (*Clemmys guttata*) leaves its breeding pool in May and travels to its nesting site.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; 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 can have a dramatic effect on natural resources.

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.

Potential invasive species effects to Rhode Island's wildlife are described below.

Terrestrial Mammals

In Rhode Island, white-tailed deer are the most common nuisance mammals. They destroy native vegetation resulting in erosion and water resource concerns, and can carry/transmit disease to livestock and human beings. This, in turn, can seriously reduce native populations of animals and lead to the degradation of their habitat.

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. Invasive species effects to terrestrial mammals could be minimized following BMPs in Chapter 17 to reduce the introduction potential from heavy equipment or laborers.

Marine Mammals

Invasive species displace native fauna and flora communities and/or radically change the nature of the habitats they invade. They also compete for the same natural resources and life requirements (i.e., food, space, and shelter) as native species and degrade local ecologies by disrupting the food chain, thereby causing the extinction of native species. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would not occur.

Birds

Invasive plant and pest species directly alter the landscape or habitat to a condition that is more favorable for an invasive species, and less favorable for native species and their habitats. For example, in Rhode Island, mute swans (*Cygnus olor*) can impact native waterfowl and wetland birds causing nest abandonment or impacts to rearing young due to their aggressive behavior (RIDEM, 2016d). 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.

Reptiles and Amphibians

No invasive reptiles or amphibians are regulated in Rhode Island; although non-native reptiles and amphibians are known to occur there. Non-native reptiles and amphibians tend to be highly adaptable and can threaten native wildlife by competing with them for food sources and also spread disease. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would be limited. Invasive terrestrial reptile or amphibian species are not expected to be introduced at project sites from machinery or laborers.

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 pose a large threat to forest and agricultural resources. Species such as the gypsy moth (*Lymantria dispar*), hemlock woolly adelgid (*Adelges tsugae*), Asian longhorn beetle (*Anoplophora glabripennis*), and emerald ash borer (*Agrilus planipennis*) are of particular concern in Rhode Island and are known to cause irreversible damage to native forests. The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance can 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 would help to avoid or minimize the potential for introducing invasive plant species during implementation of the Proposed Action. Invasive species effects related to terrestrial invertebrates could be minimized with the implementation of BMPs and mitigation measures.

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 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.

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., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing, could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects if BMPs and mitigation measures are not implemented.
  - 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 individual species 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.
  - 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 impact wildlife, marine mammals in particular (see Section 13.2.4, 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, and SOWs could result in direct injury/mortalities to wildlife on roadways. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. RF hazards could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. 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 given the small-scale of likely individual FirstNet projects; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts. 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to wildlife resources associated with routine inspections of the Preferred Alternative. Site maintenance would be infrequent, including mowing or limited application of herbicides, may result in less than significant effects to wildlife including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

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 individual wildlife species and unlikely to cause population-level impacts, and therefore would likely than less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to wildlife resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wildlife resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts 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 because deployment activities are expected to be temporary, likely affecting only a small number of wildlife. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts because deployable activities are expected to be temporary and likely affecting only a small number of wildlife. The impacts can vary greatly among species and geographic region. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wildlife resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 13.1.6.4, Wildlife.

13.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Rhode Island and Rhode Island's near offshore environment 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 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 13.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, individual behavior of fish species would be short-term and 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

Habitat impacts are primarily physical perturbations 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 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. Additionally, deployment activities with the potential for impacts under the MSFCMA or other sensitive aquatic habitats can be addressed through BMPs and mitigation measures.

Indirect Injury/Mortality

Water quality impacts from exposure to contaminants from accidental spills from vehicles and equipment, and erosion or sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, streams, and other aquatic habitats could result in changes to habitat, food sources, or prey resulting in indirect mortality/injury to fish and aquatic invertebrates. Indirect injury/mortality impacts vary depending on the species, time of year, and duration of deployment. These impacts are expected to be less than significant, and BMPs and mitigation measures to protect water resources (see Section 13.2.4, 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 are expected to be less than significant, and are anticipated to be localized and at a small-scale, and would vary depending on the species, time of year, and duration of deployment. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

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 can 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 expected to be less than significant, though BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive plants within construction zones can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site 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 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.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to fisheries and aquatic habitats under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to 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 fisheries and aquatic habitats because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have no impact on the aquatic environment.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore 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 (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated

structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to fisheries and aquatic habitats. However, if 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 habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be less than significant due to the small-scale of deployment activities and the limited number of aquatic species expected to be impacted. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance, if conducted near water resources that support fish, including application of herbicides, may result in less than significant effects to fisheries and aquatic habitats including exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

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 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.

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.

<u>Deployment Impacts</u>

As explained above, implementation of deployable technologies could result in less than significant impacts 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 due to the limited nature of expected deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

Operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, 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. The impacts can vary greatly among species and geographic region. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to fisheries and aquatic habitats as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 13.1.6.5, Fisheries and Aquatic Habitats.

13.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Rhode Island and Rhode Island'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 17, 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 13.2.6-2. 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 13.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Injury/Mortality of a Listed Species	Magnitude or Intensity	As per the ESA, this impact threshold applies at the individual level so applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under likely to adversely affect category). Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Includes permitted take.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species.	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to infrequent, temporary, and short-term effects.	
Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success of a listed species.	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success.	No measurable effects on listed species.
	Geographic Extent	Reduced breeding success of a listed species at any geographic extent.	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success of listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success of a listed species.	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success of a listed species within a breeding season.	
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat.
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 13.2.6-2, any direct injury or mortality of a listed species at the individual-level could be potentially significant as well as any impact that has more than a negligible potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency. Direct injury/mortality environmental concerns pertaining to federally listed terrestrial mammals, birds, reptiles, invertebrates, and plants with known occurrence in Rhode Island are described below. There are no listed marine mammals or fish in Rhode Island; therefore, they will not be discussed below.

<u>Terrestrial Mammals</u>

Direct mortality or injury to the federally listed Northern long-eared bat (*Myotis septentrionalis*) could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present. While projects would not likely directly affect winter hibernacula (e.g., caves), human disturbance in and around hibernacula when bats are present could lead to adverse effects to this species; when disturbed by noise or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (USFWS, 2015e).

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 17, may be implemented as appropriate to further minimize potential impacts.

<u>Birds</u>

Three federally listed birds are known to occur within coastal areas of Rhode Island. 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. If proposed project sites are 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 17, may be implemented as appropriate to further minimize potential impacts.

<u>Reptiles and Amphibians</u>

There are no federally listed amphibians in Rhode Island.

Three federally listed sea turtles are believed or known to occur in the coastal area and offshore environment of Rhode Island. None of these turtles nest in the Rhode Island area. Direct mortality or injury from watercraft and vessel strikes and unlikely as the majority of the FirstNet deployment projects would not occur in an aquatic environment. 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 17, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

One endangered terrestrial invertebrate occurs in Rhode Island. Direct mortality or injury could occur to these species if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Distribution of these species is very limited throughout the state. 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 17, may be implemented as appropriate to further minimize potential impacts.

Plants

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. In general, distribution of these species is limited throughout the state. 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 17, 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 can affect the breeding success. Potential effects to federally listed terrestrial mammals, birds, terrestrial reptiles and marine reptiles and amphibians, invertebrates, and plants with known occurrence in Rhode Island are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect the Northern longed-eared bat. Impacts would be directly related to the frequency, intensity, and duration of 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 17, may be implemented as appropriate to further minimize potential impacts.

Birds

The piping plover, red knot, and roseate tern are the only federally listed bird species that are known to nest in Rhode Island. Impacts to their habitat due to land clearing or excavation activities could directly affect nesting if deployment activities occur during the breeding/nesting season. In addition, habitat loss or degradation could lead to indirect affects to nesting due to birds having to find new nesting sites. Further, noise, light, or human disturbance within nesting areas could cause the federally listed birds to abandon their nests, relocate to less desirable locations, or cause stress to individuals reducing survival and reproduction. 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 17, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Rhode Island does not have any federally listed terrestrial amphibians.

The three federally listed sea turtles found in the coastal areas of Rhode Island are migrants. Consequently, no long-term reproductive effects to federally listed sea turtles are expected as a result of the Proposed Action.

Invertebrates

Ground disturbing activities can cause stress resulting in lower productivity for the federally listed beetle known to occur in Rhode Island. Distribution of this species is very limited throughout the state. 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 17, may be implemented as appropriate to further minimize potential impacts.

Plants

No reproductive effects to federally listed plants are expected as a result of the Proposed Action as limited pesticides would be used and avoidance measures could be undertaken.

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, birds, reptiles, invertebrates, and plants with known occurrence in Rhode Island are described below.

Mammals

Direct mortality or injury to the federally listed Northern long-eared bat (*Myotis septentrionalis*) could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present. While projects would not likely directly affect winter hibernacula (e.g., caves), human disturbance in and around hibernacula when bats are present could lead to adverse effects to this species; when disturbed by noise or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (USFWS, 2015e). It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. 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 17, 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 vast distances often involving many different countries. Disturbance in stopover, foraging, or breeding areas (visual or noise) or habitat loss/fragmentation can 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 adverse effects to federally listed birds. 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 17, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

There are no federally listed amphibians in Rhode Island. Disturbances during deployment activities are not anticipated to stress the federally listed sea turtles. 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 17, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Habitat loss or alternation, and introduction of invasive species could impact food sources for federally listed beetle resulting in changes in behavior. 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 17, may be implemented as appropriate to further minimize potential impacts.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary for geographic extant. FirstNet activities are generally expected to be small-scale in nature, therefore large-scale impacts are not expected; however, it is possible that small-scale changes could lead to potentially significant adverse effects for certain species. For example, impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically. However, the threatened and endangered species that occur in Rhode Island do not have critical habitat in the state.

Terrestrial Mammals

No designated critical habitat occurs for terrestrial mammals in Rhode Island. 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

No critical habitat has been designated for listed birds known to occur in Rhode Island; therefore, no effect to these federally listed birds from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Reptiles and Amphibians

No designated critical habitat occurs for reptiles or amphibians in Rhode Island. 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.

Invertebrates

No designated critical habitat occurs for terrestrial invertebrates in Rhode Island. 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.

Plants

No designated critical habitat occurs for plants in Rhode Island. 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.

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 13.1.2, 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 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.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 13.1.2, Proposed Action Infrastructure, the following are expected to have no impacts to threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened and endangered because those activities would not require ground disturbance.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact protected species, it is anticipated that this activity would have no impact on protected species.

Activities with the Potential to Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g., reptiles,

mollusks, small mammals, and young), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (e.g., ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat if BMPs and mitigation measures are not implemented.

- 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 threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed and the extent of ground disturbance, 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 impact threatened and endangered species and their habitat, particularly aquatic species (see Section 13.2.4, 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. These impacts may affect, but are not likely adversely affect protected species; BMPs and mitigation measures identified in Chapter 17 and as defined through consultation with the appropriate resource agency, could help to mitigate or reduce 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 due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect threatened and endangered species, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. 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 17, may be implemented as appropriate to further minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts 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 impacts to threatened and endangered species as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species through direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. 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 17, may be implemented as appropriate to further minimize potential impacts.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that activities may affect, but are not likely to adversely affect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. 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 17, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no effects to threatened and endangered species as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 13.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

13.2.7. Land Use, Recreation, and Airspace

13.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Rhode Island associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.7.2. 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 13.2.7-1. As described in Section 13.2, 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.

13.2.7.3. Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other 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 rights-of-way or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the right-of-way, 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 13.2.7-1, 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.

Table 13.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and 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
	Duration or Frequency	Permanent: Land use altered indefinitely		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities	Effect that is potentially significant, but with mitigation is less than significant	Restricted access to recreation land or activities	No disruption or loss of access to recreational lands or activities
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory	NA
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites	Effect that is potentially significant, but with mitigation is less than significant	Small reductions in visitation or duration of recreational activity	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory	NA
	Duration or Frequency	Persists during or beyond the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace	Effect that is potentially significant, but with mitigation is less than significant	Alteration to airspace usage is minimal	No alterations in airspace usage or flight patterns
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Permanent: Airspace altered indefinitely		Short-Term: Airspace altered for as long as the entire construction phase or a portion of the operations phase	NA

NA = not applicable

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other 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 right-of-way, 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 13.2.7-1, less than significant impacts would be anticipated as any new land use would be small-scale and consistent with the surrounding land uses in the area; only short-term impacts during the construction phase would be expected.

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 rights-of-way 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 13.2.7-1, 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 13.2.7-1, 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. 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 13.2.7-1, 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 not impact airspace resources.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure, and the specific deployment requirements, some activities would result in potential impacts to land use and recreation, and others would not. Impacts to airspace are not anticipated as these activities would comply with all FAA regulations. 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 land use, recreation, and airspace resources under the conditions described below:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - <u>Land Use</u>: See *Activities Likely to Have Impacts* below.

    - Recreation: See *Activities Likely 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 FAA Section 13.1.7-3, Obstructions to Airspace Considerations).
- Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: It is anticipated that there would be no impacts to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (See FAA Section 13.1.7-3, Obstructions to Airspace Considerations).
- New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: See *Activities Likely to Have Impacts* below.
    - Recreation: See *Activities Likely 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 Likely to Have Impacts* below.
  - Recreation: See *Activities Likely 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 FAA Section 13.10.5.3 Obstructions to Airspace Considerations).
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
  - Land Use: See *Activities Likely to Have Impacts* below.
  - Recreation: See *Activities Likely 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 FAA Section 13.10.5.3 Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See *Activities Likely to Have Impacts* below.

        - Airspace: See *Activities Likely 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 obstruction to airspace criteria listed in FAA Section 13.1.7-3, Obstructions to Airspace Considerations. The section below addresses potential impacts from balloons and drones.
- 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, it is anticipated that this activity would have no impact on land use.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to land use, recreation resources, or airspace as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - <u>Land Use</u>: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - <u>Recreation</u>: 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.
    - <u>Airspace</u>: 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) rights-of-way or easements and the potential construction of access roads.
    - <u>Land Use</u>: 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 rights-of-way 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.
    - <u>Recreation</u>: 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.
    - <u>Airspace</u>: 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.
    - <u>Land Use</u>: 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 the other criteria listed in FAA Section 13.1.7-3, Obstructions to Airspace Considerations. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight patterns of an airport if the aerial fiber optic plant is located in proximity to one of Rhode Island'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: No impacts are anticipated.
- 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 Rhode Island airports (See obstruction criteria in FAA Section 13.1.7-3, Obstructions to Airspace Considerations). 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.
- 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 are expected to be less than significant 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 13.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections. 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. The degree of change in the visual environment (see Section 13.2.8, 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. 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. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.7.4. 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. 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 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall these potential impacts would be less than significant due to the temporary nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 13.10, Land Use, Recreation, and Airspace.

13.2.8. Visual Resources

13.2.8.1. Introduction

This section describes potential impacts to visual resources in Rhode Island associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 13.2.8-1. As described in Section 13.2, 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 13.2.8-1: 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

13.2.8.3. 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 Rhode Island, residents and visitors travel to many national and state parks and historic areas, including the Blackstone River Valley National Heritage Corridor to view the expansive riparian corridor and explore historic towns and sites. 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.

Rhode Island has implemented several regulations for the direct and indirect protection of scenic resources, including the Rhode Island Comprehensive Planning and Land Use Act, the Rhode Island State Land Use Policies and Plan, and the State of Rhode Island Coastal Resources Management Program. These and other policies regulate land use and the effects to visual resources, and many provide management and protection for scenic resources throughout the state. 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 13.2.8-1, 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.

Based on the impact significance criteria presented in Table 13.2.8-1, lighting that illuminates the night sky on a regional basis, diminishes night sky viewing over long distances, and persists over the long-term would be considered potentially significant. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience potentially significant impacts to night skies.

13.2.8.4. 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.

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, attaching equipment to satellites launched for other purposes, 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 rights-of-ways 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 located in or near a national park unit or other sensitive area.

If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if 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 due to the temporary and small-scale nature of deployment activities.

Depending on specific design, Construction of New Wireless Communication Towers or Installation of Optical Transmission or Centralized Transmission Equipment options could introduce new artificial lighting, due to FAA regulations or other security concerns. New lighting associated with FirstNet structures could contribute incrementally to sky glow. As a result of the temporary nature of deployment, these effects would be less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park would be less than significant with BMPs and mitigation measures incorporated during operations. Additionally, FirstNet would work closely with the National Park Service (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.

13.2.8.5. 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 as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to visual resources associated with routine inspections 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. These potential impacts would be similar to the potential impacts described for the Deployable Technologies option of the Preferred Alternative, above, only likely with greater numbers of deployable units.

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 13.1.8, Visual Resources.

13.2.9. Socioeconomics

13.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Rhode Island associated with deployment and operation of the Proposed Action. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 13.2.9-1. As described in Section 13.2, 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 13.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift	Effect that is potentially significant, but with mitigation is less than significant	Indiscernible impact to property values and/or rental fees	No impacts to real estate in the form of changes to property values or rental fees
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift	Effect that is potentially significant, but with mitigation is less than significant	Indiscernible economic change	No change to tax revenues, wages, major industries, or direct spending
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated cities/towns	NA
	Duration or Frequency	Persists during or beyond the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Impacts to employment	Magnitude or Intensity	High level of job creation at the state or territory level	Effect that is potentially significant, but with mitigation is less than significant	Low level of job creation at the state/territory level	No job creation due to project activities at the state/territory level
	Geographic Extent	Regional impacts observed throughout the state/territory		Effects realized at one or multiple isolated cities/towns	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Changes in population number or composition	Magnitude or Intensity	Substantial increases in population, or changes in population composition (age, race, gender)	Effect that is potentially significant, but with mitigation is less than significant	Minor increases in population or population composition	No changes in population or population composition
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one or multiple isolated locations	NA
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA

NA = Not Applicable

13.2.9.3. 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 Tax Revenues, Wages, Major Industries, or Direct Spending;
- 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 likely 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 Existing Environment, property values vary across Rhode Island. Median values of owner-occupied housing units in the 2009–2013 period ranged from nearly $320,000 in the Charleston area, to approximately $238,000 in the Providence area (Rhode Island portion). 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 Tax Revenues, Wages, Major Industries, or Direct Spending

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary 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, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's partner(s) may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

FirstNet may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment is a 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 games are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Existing Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across Rhode Island. The average unemployment rate in 2014 was 7.7 percent, higher than the national rate of 6.2 percent. All counties in Rhode Island had unemployment rates above the national average, with highest county unemployment rates occurring in the northern portion 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 located in one or a few specific offices. While such employment concentrations could be important to specific communities, these and other employment impacts would still not be significant based on the criteria in Table 9.2.2-1 because they would not constitute a "high level of job creation *at the state or territory level.*"

Changes in Population Number or Composition

In general, changes in population numbers occur when employment increases or decreases to a degree that affects the decisions of workers on where they can find employment; that is, when workers and their families move to or leave an area because of employment opportunities or the lack thereof. As noted above, deployment and operation of the NPSBN is likely to generate new employment opportunities (directly and indirectly), but employment changes would not be large enough in any state to be considered significant. Therefore, it is highly unlikely that the NPSBN would lead to significant changes in population numbers according to the significance criteria table above. Further, it is unlikely that the NPSBN would lead to any measurable changes in population numbers in any geographic areas, with the possible exception of cities where companies that win major NPSBN contracts establish centers for NPSBN deployment and operation activities. Smaller numbers of employees in any area would not produce measurable population changes because population is always in flux due to births, deaths, and in-migration and out-migration for other reasons.

Population composition refers to age, gender, race, ethnicity, and other characteristics of the individuals making up a population. Given the low potential for changes to population numbers, it is highly unlikely that the NPSBN would lead to any changes in population composition.

13.2.9.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. Even if the expenditure and income generation levels are very small for each project, and not significant across the entire state, they are measurable socioeconomic 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 indicates which of the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity.

- Impacts to Real Estate
- Changes to Spending, Income, Industries, and Public Revenues
- Impacts to Employment
- 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
    - Impacts to Employment
  - 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
    - Impacts to Employment
  - 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
    - Impacts to Employment
  - 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
    - Impacts to Employment

        - 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
        - Impacts to Employment
    - 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
        - Impacts to Employment
    - 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
        - Impacts to Employment
- 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).
        - Changes to Spending, Income, Industries, and Public Revenues
        - Impacts to Employment
    - 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
        - Impacts to Employment
    - 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.

    - Changes to Spending, Income, Industries, and Public Revenues
    - Impacts to Employment

- 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
    - Impacts to Employment

In general, the abovementioned activities would have less than significant beneficial socioeconomic impacts. To the extent that certain activities could have adverse impacts to property values, those impacts are also expected to be less than significant, as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

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.
- 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.

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 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 state. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.9.5. 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.

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 as described above. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be less than significant.

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 as they would be limited to a relatively small number of sites within the region and state. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated deployment or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to socioeconomics from deployment and operation of the No Action Alternative. Socioeconomic conditions would therefore be the same as those described in Section 13.1.9, Socioeconomics.

13.2.10. Environmental Justice

13.2.10.1. Introduction

This section describes potential impacts to environmental justice in Rhode Island associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 13.2.10-1. As described in Section 13.2, 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 13.2.10-1: Impact Significance Rating Criteria for Environmental Justice

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 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

13.2.10.3. 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. 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.

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 Existing Environment (Section 13.1.10) as having moderate potential or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 13.1.9, Rhode Island's minority population percentages are mostly lower than those of the region and the nation. The state's percentage of persons in poverty is slightly higher than that of the region, and lower than that of the nation. Rhode Island has a concentrated area with high potential for environmental justice populations in the central Providence area. Some additional high potential areas occur in other portions of the state. Areas with moderate potential for environmental justice populations are fairly evenly distributed across the state. Further analysis using the data developed for the screening analysis in Appendix D 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, 2015h; USEPA, 2014h).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts can 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.

13.2.10.4. 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.

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 new ground disturbance, and 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.

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, 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Activities to Have No 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. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.10.5. 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 because they would be temporary in nature. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) that could negatively affect the value of surrounding properties. In addition, equipment maintenance activities at such facilities may temporarily generate noise, and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant as operations are expected to be temporary in nature. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to environmental justice as a result of deployment and operation of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 13.1.10 Environmental Justice.

13.2.11. Cultural Resources

13.2.11.1. Introduction

This section describes potential impacts to cultural resources in Rhode Island associated with deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.11.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 13.2.11-1. As described in Section 13.2, 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.

13.2.11.3. 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 13.2.2-1, 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 that archaeological sites and historic properties are present throughout Rhode Island, some deployment activities may be in these same areas, in which case BMPs (see Chapter 17) 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.

Table 13.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse effect	**Mitigated adverse effect[a]**	**Effect, but not adverse**	**No effect**
Physical damage to and/or destruction of historic properties[b]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
	Geographic Extent	Direct effects APE		Direct effects APE	Direct effects APE
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties		Permanent direct effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
Indirect effects to historic properties (i.e., visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a contributing or non-contributing portion of a single or many historic properties	No indirect effects to historic properties
	Geographic Extent	Indirect effects APE		Indirect effects APE	Indirect effects APE
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties	No indirect effects to historic properties
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No direct or indirect effects to historic properties
	Geographic Extent	Direct and/or indirect effects APE		Direct and/or indirect effects APE	Direct and/or indirect effects APE

Type of Effect	Effect Characteristics	Impact Level			
		Adverse effect	**Mitigated adverse effect[a]**	**Effect, but not adverse**	**No effect**
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties	No direct or indirect effects to historic properties
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	Adverse effect that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No segregation or loss of access to historic properties
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties	No segregation or loss of access to historic properties
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties		Infrequent, temporary, or short-term changes in access to a single or many historic properties	No segregation or loss of access to historic properties

[a] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/THPO and other consulting parties, including 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 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.

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. Significant impacts such as these can be avoided or minimized through BMPs (see Chapter 17).

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 Native Americans. It is anticipated that FirstNet would identify potential impacts to such areas by conducting research on particular areas and through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

13.2.11.4. 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, 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 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 2.1.3, 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
  - It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or 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 POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - 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 Rhode Island where sea level was lower during glacial periods have the potential to contain archaeological sites, as well as sites associated with the state’s significant maritime history since European colonization, such as shipwrecks. Impacts to cultural resources could also potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable, which could result in the disturbance of archaeological

and historical sites, such as wharves and seawalls (archaeological deposits tend to be located in association with bodies of water, and Rhode Island, for example, has numerous maritime archaeological sites associated with its 18th and 19th century commercial expansion), and the associated network 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 impacts to archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas that have larger concentrations of historic buildings.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment site. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties, however, due to the small-scale of expected activities, these actions could affect but would not likely adversely 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.

13.2.11.5. Alternatives Impact Assessment

The following section assesses potential impacts to cultural resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to cultural resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse effect to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be no effects to cultural resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur, however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA.

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 13.1.11, Cultural Resources.

13.2.12. Air Quality

13.2.12.1. Introduction

This section describes potential impacts to Rhode Island's air quality from deployment and operation of the Proposed Action and Alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Rhode Island's air quality were evaluated using the significance criteria presented in Table 13.2.12-1. As described in Section 13.2, 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 Rhode Island's air quality addressed in this section are presented as a range of possible impacts.

13.2.12.3. 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 unknown 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. 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 Rhode Island that are in maintenance or nonattainment for one or more criteria pollutants, particularly, ozone is a state-wide issue (see 13.1.12, Air Quality and Figure 13.1.12-1). There are five counties in Rhode Island designated as maintenance areas for Ozone (see Table 13.1.12-3).

Based on the significance criteria presented in Table 13.1.12-1, air emission impacts would be 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. Given that nonattainment areas are present throughout Rhode Island (Figure 13.1.12-1), 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.

Table 13.2.12-1: Impact Significance Rating Criteria for Rhode Island

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased air emissions	Magnitude or Intensity	Pollutant concentrations would exceed one or more NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would cause an area to be out of attainment for any NAAQS. Projects do not conform to the SIP covering nonattainment and maintenance areas.	Effect that is potentially significant, but with mitigation is less than significant	Negligible emissions would occur for any criteria pollutants within an attainment area but would not cause a NAAQS exceedance.	Action would not cause pollutant concentrations to exceed the NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would not cause air quality to go out of attainment for any NAAQS. Projects are *de minimis* or conform to the SIP covering nonattainment and maintenance areas.
	Geographic Extent/Context	NA		NA	NA
	Duration or Frequency	Permanent or long-term		Short term	Temporary

NA = not applicable

13.2.12.4. 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.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1, 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 the Potential to Impact Air Quality

Construction, deployment, and operation activities related to the Preferred Alternative could impact air quality by generating various quantities of criteria 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 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, POPs, 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 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 due to the limited nature of the deployment. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be less than significant impacts to air quality 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 as they would still be limited in nature.

13.2.12.5. 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 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 concentrations and associated impacts would be dictated by the products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

13.2.13. Noise

13.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and alternatives in Rhode Island. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 13.2.13-1. As described in Section 13.2, 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 Rhode Island addressed in this section are presented as a range of possible impacts.

13.2.13.3. 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.

Based on the significance criteria presented in Table 13.2.13-1, 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 would be followed 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.

Table 13.2.13-1: 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

13.2.13.4. 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.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios, 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 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 points 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: Submarine Fiber Optic Plant: The installation of cables in limited 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 also 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, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. 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 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). See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be less than significant and for 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.

13.2.13.5. 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 Noise 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, given that these activities are of low-intensity and short duration. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Deployable Technologies Alternative would be similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Operation of generators could also generate noise in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise impacts could be minimal in those areas. It is anticipated that potential noise impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise impacts could result as explained above.

Operational impacts from aerial technologies would include repeated flyovers by UAS vehicles while they are needed in the area. This could generate less than significant, short-term impacts on any residential areas or other noise-sensitive receptors under the flight path of these vehicles.

However, once these operations cease, noise levels would quickly return to baseline levels. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

13.2.14. Climate Change

13.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Rhode Island associated with deployment and operation of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.14.2. 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 13.2.14-1. As described in Section 13.2, 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 266,920th) of the total U.S. emissions of 6,673 MMT in 2013 (USEPA, 2015p), 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 can provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 13.2.14-1: Impact Significance Rating Criteria for Climate

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and 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

Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. By mid-century, the total number of days above 90 ºF is projected to increase in the majority of the Northeastern states especially the southern portion of the region. Under both low and high GHG emissions scenarios, the frequency, intensity, and duration of heat waves (sequential days with temperatures over 90 ºF) is also expected to increase, with the most intense heat waves occurring under higher emissions scenarios. Increases in temperature will also impact precipitation events, sea level rise, and ocean water acidity (USGCRP, 2014a).

Air Temperature

Figure 13.2.14-1 and Figure 13.2.14-2 below illustrate the anticipated temperature changes for low and high GHG emission scenarios for Rhode Island from a 1969 to1971 baseline.

Figure 13.2.14-1 shows that by mid-century (2040 to 2059) temperatures in the entire state of Rhode Island under a low emissions scenario will increase by approximately 4 °F, and under a low emissions scenario for the period (2080 to 2099), temperatures will increase by approximately 5 °F (USGCRP, 2009).

Figure 13.2.14-1 shows that by the end of the century (2040 to 2059) temperatures in the entire state of Rhode Island under a high emissions scenario will increase by approximately 5 °F. Under a high emissions scenario by the end of the century (2080 to 2099) in the entire state of Rhode Island will increase by approximately 8 or 9 °F (USGCRP, 2009).

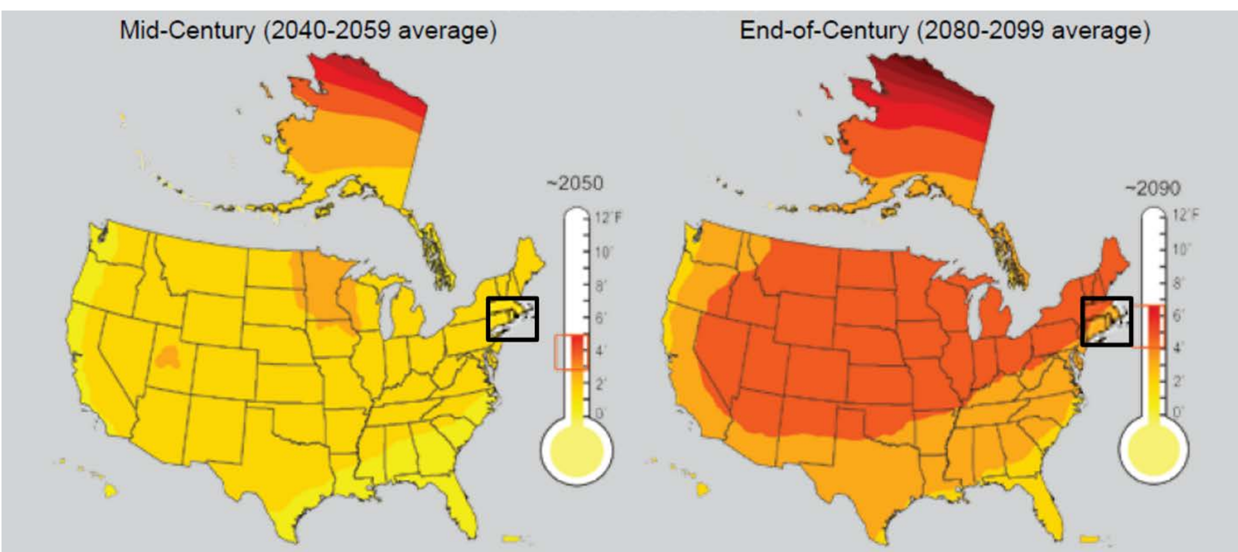

Figure 13.2.14-1: Rhode Island Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

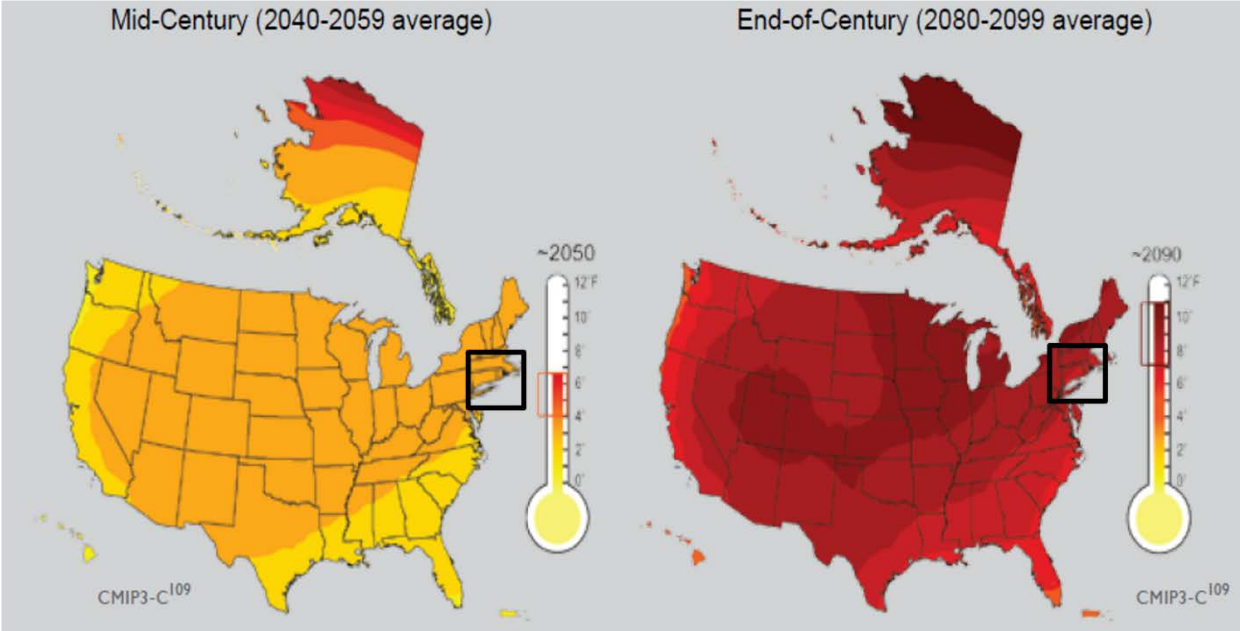

Figure 13.2.14-2: Rhode Island High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

Precipitation

By late in the century under a high emissions scenario, winters in the Northeast are projected to be much shorter with fewer cold days and more precipitation. Winter and spring precipitation is projected to increase, and the frequency of heavy downpours is projected to continue to increase as the century progresses. Seasonal drought risk is also projected to increase in summer and fall as higher temperatures lead to greater evaporation and earlier winter and spring snowmelt (USGCRP, 2009).

Figure 13.2.14-3 and Figure 13.2.14-4 show predicted seasonal precipitation change for an approximate thirty year period of 2071 to 2099 compared to a 1970 to 1999 approximate thirty year baseline. Figure 13.2.14-3 show seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050 (USGCRP, 2014b).

Figure 13.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. Continued increases in emissions would lead to large reductions in spring precipitation in the Northeast. Note: white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability (USGCRP, 2014b).

Figure 13.2.14-3 shows that in a rapid emissions reduction scenario in the 30-year period for 2071 to 2099, precipitation will increase by 10 percent in winter, spring and summer for the entire state of Rhode Island. However, there are no expected increases in precipitation in fall other than fluctuations due to natural variability (USGCRP, 2014b).

Figure 13.2.14-4 shows that if emissions continue to increase, winter and spring precipitation could increase as much as 20 percent over the period 2071 to 2099. In summer, precipitation in this scenario could increase as much as 10 percent. No significant change fall and summer rainfall is anticipated over the same period (USGCRP, 2014b).

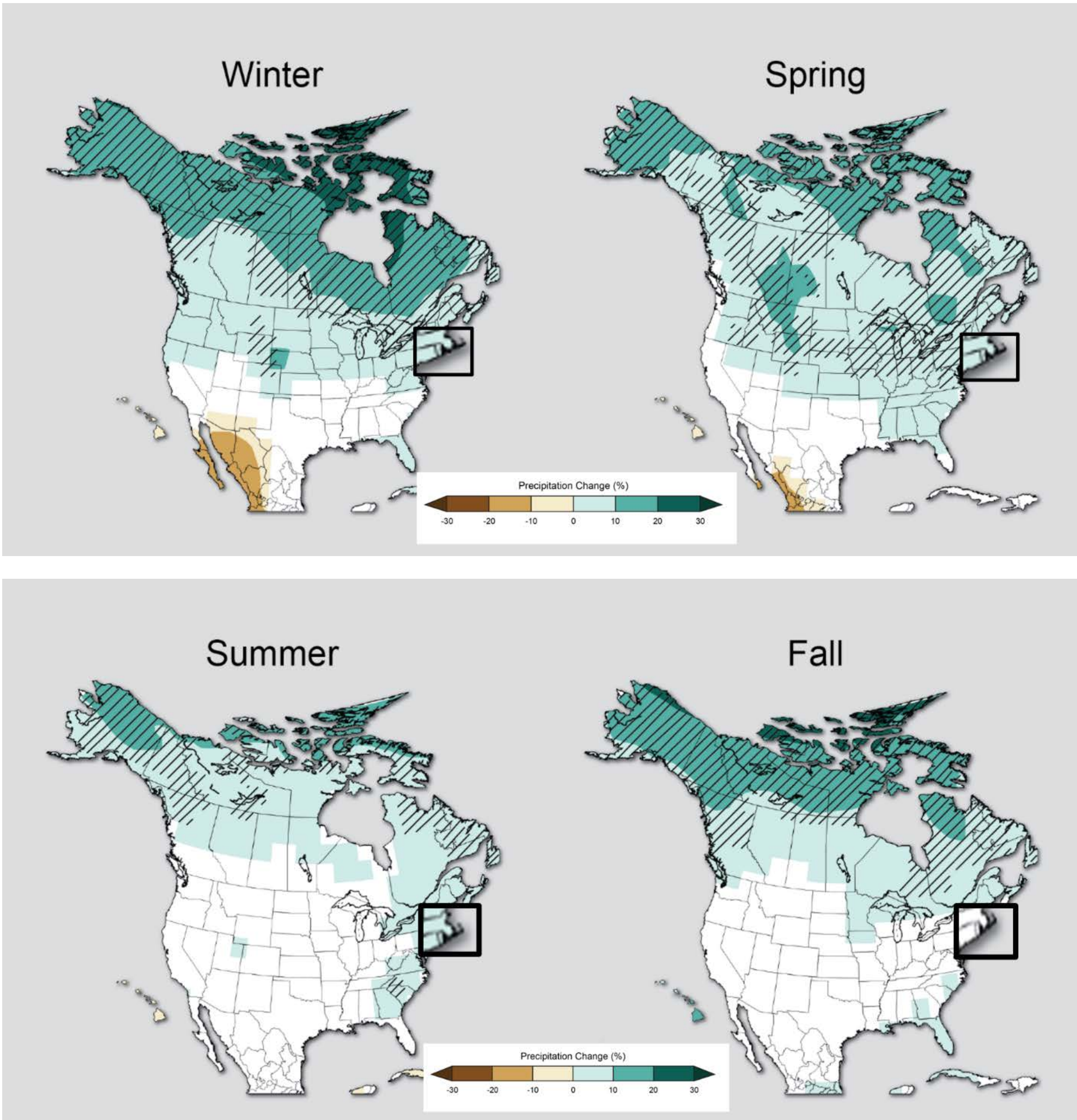

Figure 13.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

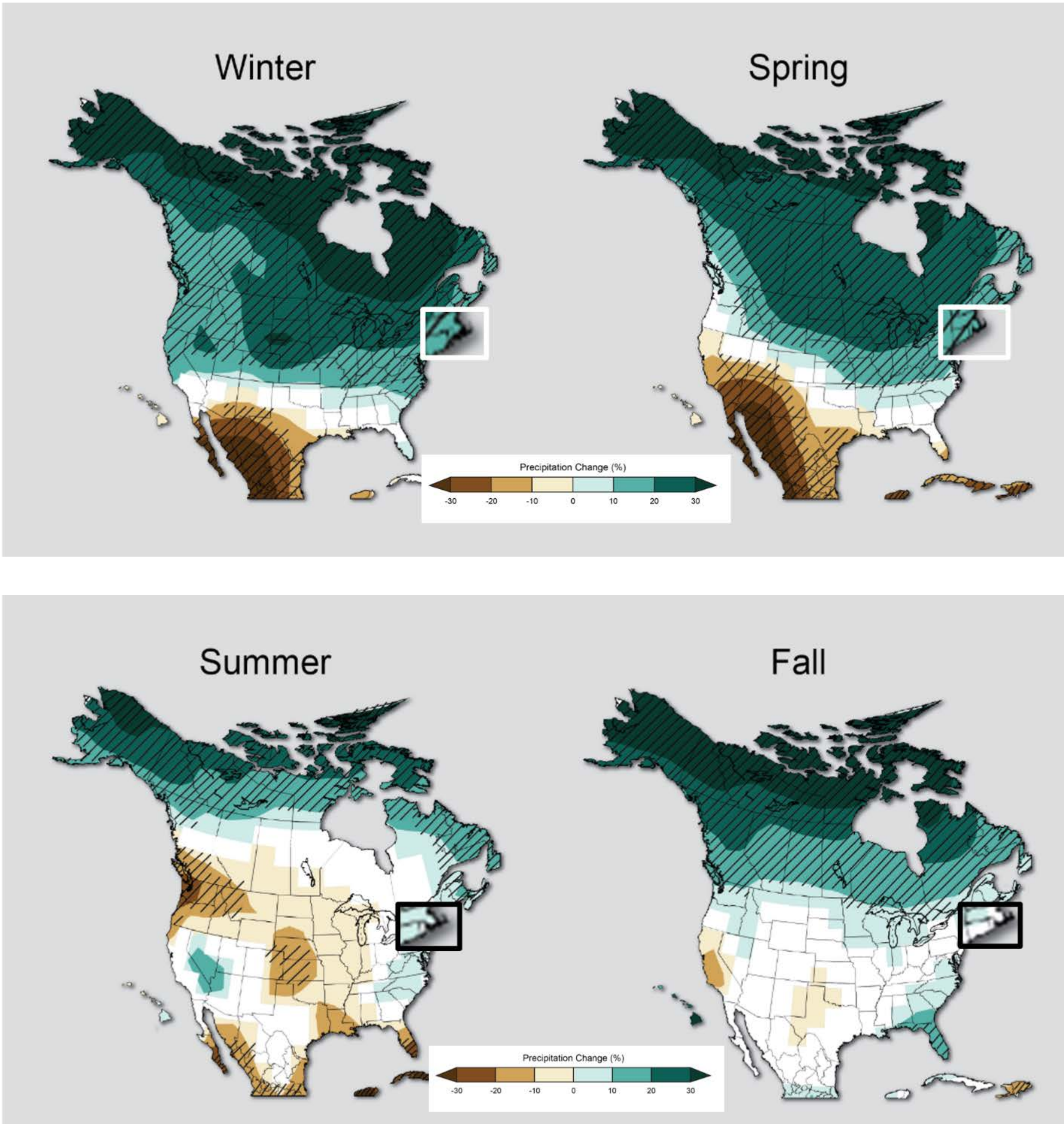

Figure 13.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2014b)

Sea Level

Several factors will 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, 2012e). 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, 2012e). "Ocean heat content also influences sea level and currents" (USEPA, 2012e).

The amount of sea level rise will 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). The National Climate Assessment (NCA) reports on potential sea level rise scenarios. These scenarios were developed based on varying degrees of ocean warming and ice sheet loss as estimated by organizations like IPCC (NOAA; USGS; SERPD; USACE, 2012). Figure 13.2.14-5 and Figure 13.2.14-6 show the change in sea level above 1992 levels at different tide gauge stations. Figure 13.2.14-5 shows an 8 inch global sea level rise above 1992 levels by 2050 and Figure 13.2.14-6 shows a 1.24 foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014c).

Figure 13.2.14-5 presents an 8 inch global average sea level rise above 1992 levels, resulting in a 0.7 to 1 foot sea level rise in 2050 on the coast of Rhode Island. Figure 13.2.14-6 indicates that a 1.24 foot sea level rise above 1992 level would result in a 1.3 to 1.7 foot sea level rise in 2050 along the coast of Rhode Island (USGCRP, 2014c).

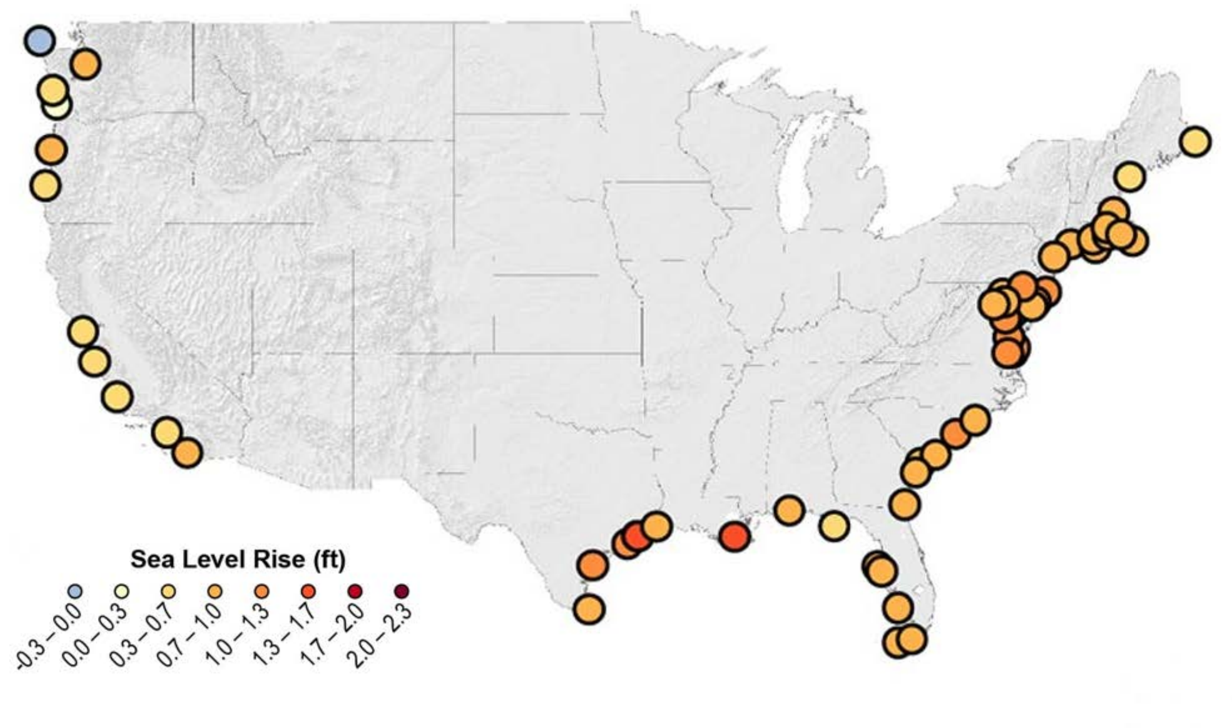

Figure 13.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014c)

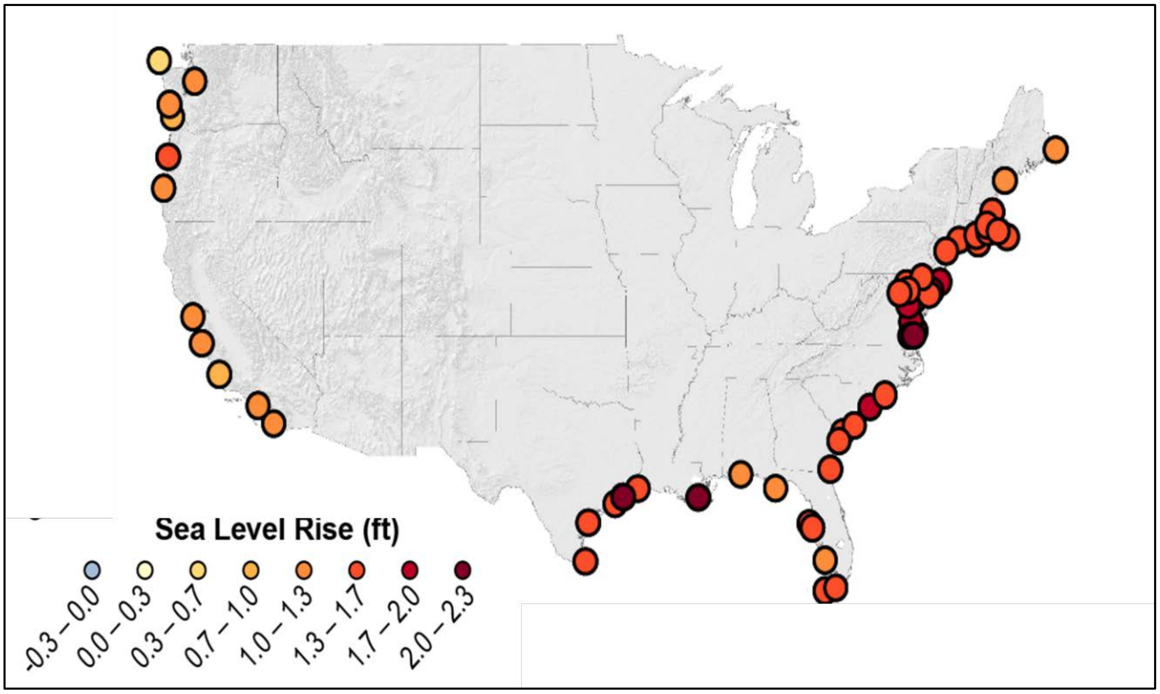

Figure 13.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014c)

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, 2014d).

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, 2014d). 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 (USDOC, 2013c).

13.2.14.3. 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 13.2.14-1, 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 (Multiquip, 2015). Diesel fuel combustion emits 22.38 lbs of CO_2 per gallon (EIA, 2015i). 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 is less carbon-intensive, and would generate approximately 240 MT of CO_2 per year for the same equipment, depending on the region of the U.S. where the electricity was generated (USEPA, 2014i). 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 (Willem Vereecken, 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. These impacts will be considered fully in Chapter 18, Cumulative Impacts. No BMPs will be described for this aspect of the resource.

Rhode Island may be at risk to more powerful hurricanes under a climate warming scenario, particularly when combined predicted increases in relative sea levels, putting at risk water and energy infrastructure, wetlands, and entire communities (Rhode Island Climate Change Commission, 2012). More frequent and severe torrential downpours will have consequences for both natural and built environments. For natural ecosystems, it would result in increased nutrient and sediment inputs to already stressed receiving waters, and negative impacts on both aquatic flora and fauna (USGCRP, 2014e). For infrastructure, this may negatively impact wastewater and drinking water treatment systems, energy systems, roads, bridges and other critical infrastructure (Rhode Island Climate Change Commission, 2012). Higher summer temperatures are projected to increase by an additional sixty days the number of days of 90 ^{o}F, with negative consequences for air quality and human health (Rhode Island Department of Health, 2015b).

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.

Stronger storms may also increase the potential for damage from high winds and wind-borne debris, for areas of Rhode Island prone to flooding, climate change is projected to increase the frequency and severity of torrential downpours which in turn may increase the potential for flash flooding in these areas, which could also damage FirstNet installations and infrastructure (Rhode Island Climate Change Commission, 2012) (USGCRP, 2014f). Rising summer temperatures and the increased intensity and duration of heat waves may raise electricity demand for air conditioning and may strain electrical grid operations (DOE, 2015) while sustained high temperatures may overwhelm the capacity onsite equipment needed to keep microwave and other transmitters cool.

13.2.14.4. 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 Rhode Island, including deployment and operation activities.

As described in Section 2.1.2, Proposed Action, 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, 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.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

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:

- Wireless Projects
  - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.

  - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
  - Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities. .
  - New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small marine sources would contribute to GHGs.
  - Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.
- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and 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 construction would not take place. 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, or SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However, this would be highly dependent on their size, number, and the frequency and duration of their use.
  - Deployable Aerial Communications Architecture: 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 due to the limited and localized nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could be potentially significant to less than significant 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. 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.

13.2.14.5. 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.

Potential 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 based on the defined significance criteria, since activities would be temporary and short-term.

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. 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 deployment and 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 due the limited duration of deployment activities.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. Climate change effects have the most noticeable impacts over a long period. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above.

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 13.1.14, Climate Change.

13.2.15. Human Health and Safety

13.2.15.1. Introduction

This section describes potential impacts to human health and safety in Rhode Island associated with deployment of the Proposed Action and alternatives. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.15.2. 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 13.2.15-1. As described in Section 13.2, 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.

13.2.15.3. 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 13.2.15-1, 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 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. For example, if fuel is spilled from an onsite fuel tank, the spilled fuel could migrate down gradient and infiltrate underground drinking water sources. The general public may then be exposed to hazardous chemicals in their drinking water if they utilize the same groundwater aquifer.

Table 13.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and 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, CERCLA, TSCA, EPCRA	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and 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

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, 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.

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.

The Rhode Island Department of Labor and Training (RIDLT) is not authorized by OSHA to administer a state program for public or private sector employers. Therefore, RIDLT defers all regulatory authority and enforcement for occupational safety relating to FirstNet site work to the leadership and interpretation of OSHA.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination and mine lands 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 of underground shaft collapses or seismic shifting. Based on the impact significance criteria presented in Table 13.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties or abandoned or active mine lands. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination and/or mining activities using federal resources such as the USEPA Cleanups in My Community database, through RIDEM, or through an equivalent commercial resource, such as Environmental Data Resources, Incorporated.

By screening sites for environmental contamination, mining activities, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination or mining activities, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination (or mine lands) are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, CERCLA, Superfund, and applicable Rhode Island 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 RIDEM 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

FirstNet is intended to improve connectivity among public safety entities during disasters, thereby improving their ability to respond more safely and effectively during such events. The addition of towers, structures, facilities, equipment, and other deployment activities is expected to allow for expedited responses during 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 13.2.15-1, 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.

13.2.15.4. 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.

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 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 due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for 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 less than significant impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for 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.

13.2.15.5. 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 also 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. 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 due to the small-scale of likely FirstNet activities that would be temporary and of short duration. See Chapter 17, BMPs and Mitigation Measures, for 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 associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, 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 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. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to human health and safety as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 13.1.15, Human Health and Safety.

RI APPENDIX A – WATER RESOURCES

Table A-1. Characteristics of Rhode Island's Watersheds as Defined by RIDEM

Watershed/Size land area within RI (square miles)	Major Surface Waterbodies	Major water quality concerns
Blackstone: 140	Arnold Mills Reservoir Blackstone River Branch River Clear River Diamond Hill Reservoir Pascoag Reservoir (Echo Lake) Slatersville Reservoir	• Stormwater runoff, • Combined sewer overflow discharges, • Failing septic systems, and • Agricultural waste
Narragansett Bay: 662	Flat River Reservoir Greenwich Bay Mount Hope Bay Narragansett Bay Pawtuxet River Ponaganset River Providence River Sakonnet River Woonasquatucket River	• Excess nutrients from wastewater treatment plants, • Invasive and other aquatic plant growth, • Legacy industrial discharges, and • Organic waste discharges
Pawcatuck: 260	Pawcatuck River Usquepaug River Wood River Worden Pond	• Pollutants from municipal sewage treatment plants, shoreline septic systems, agriculture and recreational boats, and • Urban runoff
Quinebaug: 61	Lower Fivemile River Upper Moosup River	• Pollutant from municipal wastewater treatment plants, • Urban runoff
Cape Cod: information not available	Adamsville Brook Stafford Pond Westport River	• Pollutants from agriculture, • Urban runoff, and • Storm sewers

Sources: (RIDEM, 2013e) (RIDEM, 2000) (RICRMC, 2015) (Dillingham, 1993) (Wild & Nimiroski, 2007) (RIDEM, 1998)

RI APPENDIX B – BIOLOGICAL RESOURCES

Table B-1: Rare Natural Community Types in Rhode Island

Vegetative Community Type	USEPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
Fresh Subtidal Aquatic Bed	Northeastern Coastal Zone	Southern Rhode Island	Continuously flooded substrates supporting rooted aquatic vegetation. Characteristic plants are waterweed (*Elodea* spp.), along with wild celery (*Vallisneria americana*), pondweed (*Potamogeton perfoliatus*), and naiads (*Najas* spp.).	Lower reaches of Pawcatuck River
Freshwater Tidal March	Northeastern Coastal Zone	Narragansett Bay	A marsh community occurring at the upper limits of tidal flow along streams and rivers. Includes a combination of species typical of both, including narrow-leaved cattail (*Typha angustifolia*), bulrushes (*Scirpus robustus, S. pungens*, and *S. validus*), pickerelweed (*Pontederia cordata*), arrowweed (*Sagittaria latifolia*), spatterdock (*Nuphar variegata*), saltmarsh hemp (*Amaranthus cannabinus*) and water-parsnip (*Sium suave*).	Mill Creek, Warwick, Runnins River, East Providence
Interdunal Swale	Northeastern Coastal Zone	Southern Rhode Island and Block Island	Small wetlands that occur in low areas and blowouts within coastal sand dunes where the water table is at or near the surface. Characteristic species are rushes (*Juncus canadensis, J. greenei*), beakrush (*Rhynchospora capitellata*), yellow-eyed grass (*Xyris torta*), cranberry (*Vaccinium macrocarpon*), sweet gale (*Myrica gale*), and northern bayberry (*Morella pensylvanica*).	South Shore and Block Island

Vegetative Community Type	USEPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
Coastal Plain Quagmire	Northeastern Coastal Zone	Southern Rhode Island	Vegetated shores of ponds that maintain relatively constant water levels from perennial stream inflow or recharge from bordering wetlands. Characteristic plants include threesquare (*Scirpus pungens*), bayonnet rush (*Juncus militaris*), water lobelia (*Lobelia dortmanna*), pennywort (*Hydrocotyle umbellata*), yellow-eyed grass (*Xyris difformis*). Horsetail spike-rush (*Eleocharis equisetoides*) may be present.	Tucker Pond and Worden Pond, South Kingstown
Sea Level Fen	Northeastern Coastal Zone	Southern Rhode Island	A rare community type that develops in the upper border of tidal marshes where there is freshwater influx usually from groundwater seepage. Characteristic species include twig-rush (*Cladium mariscoides*), spikerush (*Eleocharis rostellata*), and threesquare (*Scirpus pungens*).	Westerly and Narragansett
Black Spruce Shrub	Northeastern Coastal Zone	Northeastern Rhode Island	Peatland, occurring in a basin fed directly by rainfall with little groundwater influence or as floating islands in manmade reservoirs. The dominant woody plant is black spruce (*Picea mariana*). A well-developed shrub layer is characterized by leatherleaf (*Chamaedaphne calyculata*) and rhodora (*Rhododendron canadense*).	Providence County
Rich Red Maple – Ash Swamp	Northeastern Coastal Zone	Northern Rhode Island	Deciduous or mixed swamp that is somewhat enriched by groundwater flow Co-dominants are red maple and white ash and/or green ash (*Fraxinus americana*, *F. pensylvanica*) with lower abundance of yellow birch (*Betula alleghaniensis*), hemlock (*Tsuga canadensis*), Atlantic white cedar (*Chameacyparis thyoides*) and/or white pine (*Pinus strobus*).	Ash Swamp, Cumberland

Vegetative Community Type	USEPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
Inland Sand Barren	Northeastern Coastal Zone	Central and Southern Rhode Island	Sparsely vegetated community on shifting sands that are not along the ocean shore. Occurs within pitch pine forest or woodland types, consisting of lichens (*Cladonia* spp.), heather (*Hudsonia tomentosa*), little bluestem (*Schizachyrium scoparium*), umbrella sedge (*Cyperus filiculmis*), and sand jointweed (*Polygonella articulata*). The sand star fungus (*Astraeus hygrometricus*) is typically present.	Washing, Kent, and Newport counties
High Terrace Riverside Forest	Northeastern Coastal Zone	Northeastern and Southwestern Rhode Island	Forest communities on upper slopes and terraces of rivers and streams that are flooded only during peak high water events and for short durations. Characterized by tree species typical of upland mesic forests, including American beech (*Fagus grandifolia*), sugar maple (*Acer saccahrum*), white ash (*Fraxinus americana*), red oak (*Quercus rubra*), basswood (*Tilia americana*), and ironwood (*Carpinus caroliniana*), and with ferns, spring ephemerals, and other herbacesous plants characteristic of floodplains.	Blackstone and Pawcatuck Rivers

Source: (Enser & Lundgren 2006)

ACRONYMS

Acronym	Definition
AGL	Above Ground Level
AML	Abandoned Mine Lands
AQCR	Air Quality Control Region
ARPA	Act of 1979
ASL	Above Sea Level
ASPM	Aviation System Performance Metrics
ATC	Air Traffic Control
ATO	Air Traffic Organization
BGEPA	Bald and Golden Eagle Protection Act
BID	Block Island State Airport
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BYA	Billion Years Ago
CAA	Clean Air Act
CCMP	Comprehensive Conservation and Management Plan
CEQ	Council On Environmental Quality
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH4	Dioxide (CO_2), Methane
CIAC	Community Involvement Advisory Council
CIMC	Cleanups In My Community
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLT	Cell On Light Trucks
COW	Cell On Wheels
CRS	Community Rating System
CWA	Clean Water Act
EFH	Essential Fish Habitats
EIA	Energy Information Agency
EMS	Emergency Medical Services
EOP	Emission Offset Provisions
EPCRA	Community Right To Know Act
FAA	Federal Aviation Administration
FAQ	Frequently Asked Questions
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FFC	Fossil Fuel Combustion
FGDC	Federal Geographic Data Committee
FLM	Federal Land Manager

Acronym	Definition
FSDO	Flight Standards District Offices
FSS	Flight Service Station
GHG	Greenhouse Gas
GWDS	Ground Water Discharges Section
HAP	Hazardous Air Pollutant
HAP	Hazardous Air Pollutants
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
LBS	Locations-Based Services
LRFD	Local Resistance Factor Design
LRR	Land Resource Regions
LTE	Long Term Evolution
MBTA	Migratory Bird Treaty Act
MHI	Median Household Income
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tons
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MYA	Million Years Ago
N2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act of 1966, As Amended
NM	Nautical Miles
NOAA	National Ocean and Atmospheric Administration
NOTAM	Disseminated Via Notices To Airmen
NOX	Ozone
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List

Acronym	Definition
NPS	National Park Service
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NWI	National Wetlands Inventory
OE/AAA	Obstruction Evaluation/Airport Airspace Analysis
OSHA	Occupational Safety and Health Act
OTR	Ozone Transport Region
PEM	Palustrine Emergent Wetlands
PFO	Palustrine Forested Wetlands
PGA	Peak Ground Acceleration
PLUS	Preliminary Land Use Service
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSC	Public Service Commission
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PSS	Scrub-Shrub Wetlands
PVD	T. F. Green State International Airport
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
RFI	Request For Information
RGGI	Regional Greenhouse Gas Initiative
RICRMC	Rhode Island Coastal Resources Managemetn Council
RIDEM	Rhode Island Department of Environmental Management
RIDEP	Rhode Island Department of Environmental Protection
RIDLT	Rhode Island Department of Labor and Training
RIDOT	Rhode Island Department of Transportation
RIPUC	Rhode Island Public Utilities Commission
RIRC	Rhode Island Resource Conservation
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SDS	Safety Data Sheets
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO2	PM2.5 (Direct Emissions)
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures

Acronym	Definition
SOW	System On Wheels
SOX	Oxides of Sulfur
SPL	Sound Pressure Level
SSA	Sole Source Aquifer
SUA	Special Use Airspace
SWAP	State Wildlife Action Plan
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
TWA	Time Weighted Average
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UHF	Ultra High Frequency
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service’S
USGS	U.S. Geological Survey
VFR	Visual Flight Rules
VHF	Very High Frequency
VMT	Vehicle Miles Traveled
VOC	Ozone
VR	Visual Route
WCS	Wetlands Classification Standard
WST	Westerly State Airport
WWI	World War I
WWII	World War II

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The citations in this Draft PEIS reflect the most recent information on the referenced site at the time the document was being written. If the site was updated after that point, the more recent information will be incorporated, as feasible, into the final document.

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