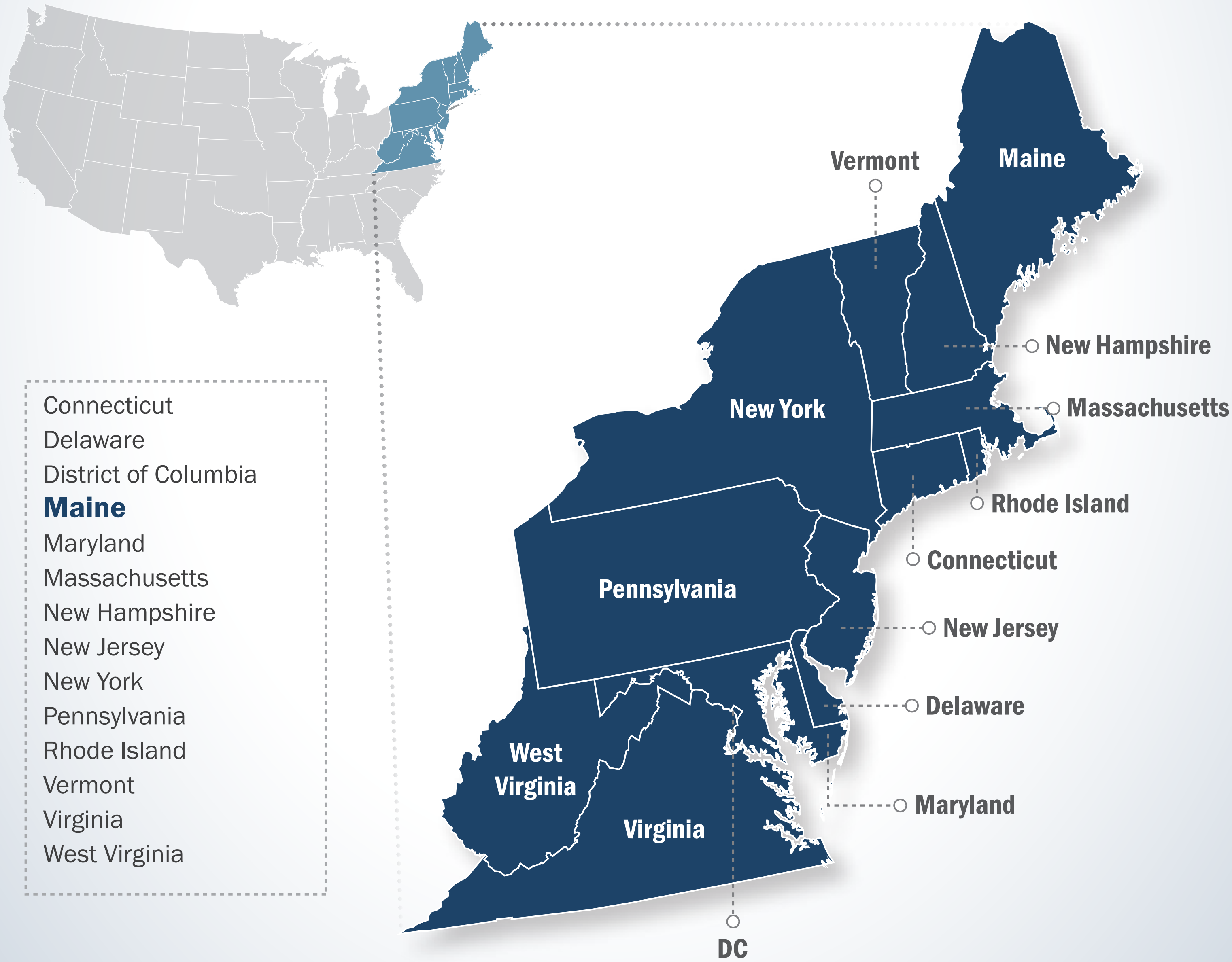
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 4 - CHAPTER 6



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First Responder Network Authority

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

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Amanda Goebel Pereira, AICP
NEPA Coordinator
First Responder Network Authority
U.S. Department of Commerce
12201 Sunrise Valley Dr. M/S 243
Reston, VA 20192

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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6 MAINE

In 1607, the Plymouth Company established the first settlement in Maine in 1607; however, the settlement did not last through the winter. Maine was part of Massachusetts until 1820, when it became a separate state (State of Maine, 2016). Maine is the northernmost of the northeastern states and is bordered by Canada to the north, New Hampshire to the west, and the Gulf of Maine and Atlantic Ocean to the east and south. This chapter provides details about the existing environment of Maine as it relates to the Proposed Action.

General facts about Maine are provided below:

- **State Nickname**: The Pine Tree State
- **Land Area:** 30,843 square miles; **U.S. Rank**: 39 (U.S. Census Bureau, 2015a)
- **Capital:** Augusta
- **Counties:** 16 (State of Maine, 2016)
- **Population:** Over 1.3 million people; **U.S. Rank:** 41 (U.S. Census Bureau, 2015b)
- **Most Populated Cites:** Portland, Lewiston, and Bangor (U.S. Census Bureau, 2015c)
- **Main Rivers:** St. John River, Aroostook River, Allagash River, Kennebec River, Saco River, Androscoggin River, Penobscot River, Mattawamkeag River, St. Croix River, and Piscataquis River
- **Bordering Waterbodies:** Atlantic Ocean and Gulf of Maine
- **Mountain Ranges:** Longfellow Mountains and a portion of the Appalachian Mountains
- **Highest Point:** Mt. Katahdin (5,268 ft) (State of Maine, 2016)

6.1 AFFECTED ENVIRONMENT

6.1.1 Infrastructure

6.1.1.1 Definition of the Resource

This section provides information on key Maine 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 6.1.1.3 provides an overview of the traffic and transportation infrastructure in Maine, including road and rail networks and airport facilities. Maine 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 providing public safety services as defined by the Act. Public safety services in Maine are presented in more detail in Section 6.1.1.4. Section 6.1.1.5 describes specific public safety communications infrastructure and commercial telecommunications infrastructure in Maine. An overview of utilities in Maine, such as power, water, and solid waste management, are presented in Section 6.1.1.6.

6.1.1.2 Specific Regulatory Considerations

Multiple Maine laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 6.1.1-1 identifies the relevant laws and regulations for Maine Infrastructure. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

Table 6.1.1-1: Relevant Maine Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Maine Revised Statutes (MRS): Title 25: Internal Security and Public Safety; Code of Maine Rules (CMR): 16 Department of Public Safety	Maine Department of Public Safety	Coordinates the state's homeland security preparedness, response, recovery, prevention, and protection activities; prepares the state's emergency management plan and coordinates the preparation of emergency management plans
MRS: Title 35-A: Public Utilities; CMR: 65 Public Utilities Commission	Public Utilities Commission	Regulates gas, natural gas pipeline, electric transmission and distribution, telephone, and water utilities

[1] The term "public safety entity" means an entity that provides public safety services (7 U.S. Code [U.S.C.] § 140126)).

State Law/Regulation	Regulatory Agency	Applicability
MRS: Title 23: Transportation; CMR: 17 Department of Transportation	Maine Department of Transportation	Plans, designs, constructs, and maintains the state's transportation infrastructure including highways, bridges, railroads, ferries, harbors, mass transit, airports, and bicycle and pedestrian facilities and regulates their use

6.1.1.3 Transportation

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

The Maine Department of Transportation (MaineDOT) has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state; local counties have jurisdiction for local streets and roads. MaineDOT's mission is "to responsibly provide our customers the safest and most reliable transportation system possible, given available resources;" the agency's goals are to manage the existing transportation system, support economic opportunity, and build trust (MaineDOT, 2015a).

Maine has an extensive and complex transportation system across the entire state. The state's transportation network is comprised of:

- 22,669 miles of public highways and 3,566 bridges (MaineDOT, 2002);
- 1,200 miles of active railroad track (MaineDOT, 2002);
- 186 aviation facilities that includes both public and private airports (FAA, 2015a);
- 52 harbors (U.S. Harbors, 2015); and
- 18 ferry terminals and 11 ocean and municipal ports (MaineDOT, 2002).

Road Networks

As identified in Figure 6.1.1-1, the major urban centers of the state from north-south are Presque Isle, Bangor, Augusta, Lewiston, and Portland. Maine has one major interstate connecting its metropolitan areas to one another, as well as to other states; Maine also has one minor interstate. Travel to local towns is conducted mainly via state and county routes. Table 6.1.1-2 lists the interstates and their start/end points in Maine. 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 (U.S. Department of Transportation, 2015a).

Table 6.1.1-2: Maine Interstates

Interstate	Southern or Western Terminus in ME	Northern or Eastern Terminus in ME
I-95	NH line at Kittery, ME	Canadian border at Houlton, ME
I-295	I-95 in Scarborough, ME	I-95 in West Gardiner, ME

In addition to the Interstate System, Maine has both National Scenic byways and State Scenic byways. Both National and State Scenic byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities. Figure 6.1.1-1 illustrates the major transportation networks, including roadways, in Maine. Section 6.1.8, Visual Resources, describes the National and State Scenic byways found in Maine from an aesthetic perspective.

National Scenic byways are roads with nationwide interest; these byways are designated and managed by the U.S. Department of Transportation's (DOT's) Federal Highway Administration (FHWA). Maine has four National Scenic byways:

- Acadia All-American Road: 40 miles within Acadia National Park in the northern section of Maine's coastline (FHWA, 2015a);
- Old Canada Road Scenic byway: 78.2 miles of U.S. Route 201 from Lakewood, Maine to Quebec in western Maine (FHWA, 2015b);
- Rangeley Lakes Scenic byway: 35.6 miles in western Maine around Rangeley Lake (FHWA, 2015c)*;* and
- Schoodic Scenic byway: 29 miles in the northern section of Maine's coastline, from Hancock, Maine, through Acadia National Park, to Prospect Harbor, Maine (FHWA, 2015d).

State Scenic byways are roads with statewide interest; State Scenic byways are designated and managed by MaineDOT. Maine has 10 State Scenic byways that crisscross the entire state (MaineDOT, 2015b):

- Blackwoods (Route 182)
- Fish River (Route 11)
- Grafton Notch
- Katahdin Woods and Waters
- Million Dollar View (Route 1)
- Moosehead Lake
- Pequawket Trail (Route 113)
- Saint John Valley
- State Route 27
- The Bold Coast

Airports

Air service to the state is provided by one major international airport, which is outside Maine: Logan International Airport in Massachusetts. The largest airport in the state is Portland International Jetport (PWM), which is owned and operated by the City of Portland. In 2013, the Jetport had over 1.6 million passengers pass through its gates, moved over 24.5 million pounds of cargo, and was responsible for 46,600 operations annually (Portland International Jetport, 2015) (FAA, 2015b). Bangor International (BGR) and Northern Maine Regional Airport at Presque Isle (PQI) also operate in the state, with approximately 42,000 operations combined annually (FAA, 2015b). Figure 6.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 6.1.7, Airspace, provides greater detail on airports and airspace in Maine.

Figure 6.1.1-1: Maine Transportation Networks

Rail Networks

Maine is connected to a rail network of passenger rail (Amtrak) and freight rail. Seven railroads operate in Maine on more than 1,100 miles of track (MaineDOT, 2009). Figure 6.1.1-1 illustrates the major transportation networks, including rail lines, in Maine.

Amtrak runs one line through Maine: the Downeaster. The Downeaster runs between Maine's southernmost towns and Boston; it is popular with both tourists and people traveling to/from Boston on business. In fiscal year 2008, ridership on the Downeaster rose by 28 percent (MaineDOT, 2009). Table 6.1.1-3 provides a complete list of Amtrak lines that run through Maine.

Table 6.1.1-3: Amtrak Train Routes Serving Maine

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in Maine
Downeaster	Brunswick, ME	Boston, MA	3 hours 25 minutes	Brunswick, Freeport, Portland, Old Orchard Beach, Saco, Wells

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

In 2007, freight rail carried 90,700 carloads of freight on Maine railroads; that same year, Maine's freight rail network carried 6,731,352 tons of freight generated by Maine's economy (MaineDOT, 2009).

Harbors and Ports

Maine adheres to a Three Port Strategy implemented in 1970 to funnel development funds to three of its cargo ports: Eastport, Searsport, and Portland. Maine's cargo ports are presented in Figure 6.1.1-1 . These three ports are responsible for nearly all of the waterborne cargo exchanges in the state. Portland and Searsport handle approximately 125 million barrels of petroleum products each year. These ports have received more than $40 million (M) in improvements to terminals and facilities since 1998 (Maine OFBS, 2015). The Port of Searsport can be found on the Penobscot Bay, while the Port of Eastport is located on Moose Island at the northeastern tip of the state. The Port of Portland is the most southern of the three, located where the Fore River meets the Atlantic Ocean. In addition, Maine is home to 52 harbors (U.S. Harbors, 2015).

Ferries run from the harbors of Rockland, Bass Harbor, and Lincolnville. Rockland's ferries run from Rockland to Vinalhaven, North Haven, and Matinicus Island. The ferries at Bass Harbor run from there to Swan's Island and Frenchboro, while the harbor at Lincolnville runs a ferry to Islesboro (MaineDOT, 2015c). Ferries run straight from terminal to terminal and are equipped to handle vehicles (MaineDOT, 2015d).

Though the Port of Portland handles cargo from large ocean borne vessels, the harbor is also home to a number of small ferries, pleasure boats, passenger boats, and other attractions. It is also an ice free harbor, meaning shipping can continue year round, helping to make it the most lucrative trade port in the state, according to the U.S. Census Bureau. In 2013, Portland imported 3.64 million tons in cargo, worth $2.7 billion (B). The same year, Portland exported $67.3M in cargo, weighing 58.9 thousand tons (U.S. Census Bureau, 2015d). The Port of

Eastport, on Moose Island, was the state's largest exporter of goods in 2013. That year the port exported 541.5 thousand tons in goods worth $283.6 M. It also imported approximately $1M worth of goods weighing approximately 1,102 tons (U.S. Census Bureau, 2015d). The Searsport Port provides rail access from its terminals to the Montreal, Maine, and Atlantic Railway, allowing for overland transport of goods to the inland U.S. and Canada (Searsport Maine, 2015). This port was responsible for the import of 1.1 million tons in cargo in 2013, with a value of $743M. That year, it also imported approximately 1,102 tons in goods (U.S. Census Bureau, 2015d). It should be noted that the Port of Belfast imported $39.1M and the Port of Calais exported $109M in 2013. Their respective exports and imports totaled less than $1M each (U.S. Census Bureau, 2015d).

6.1.1.4 Public Safety Services

Maine 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 may roughly follow key state demographic indicators. Table 6.1.1-4 presents Maine's key demographics including population, land area, population density, and number of municipal governments. More information about these demographics is presented in Section 6.1.9, Socioeconomics.

Table 6.1.1-4: Key Maine Indicators

Maine Indicators	
Estimated Population (2014)	1,330,089
Land Area (square miles) (2010)	30,842.92
Population Density (persons per sq. mile) (2010)	43.1
Municipal Governments (2013)	22

Sources: (U.S. Census Bureau, 2015b) (U.S. Census Bureau, 2012a) (National League of Cities, 2007)

Table 6.1.1-5 presents Maine's public safety infrastructure, including fire stations. Table 6.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 6.1.1-5: Public Safety Infrastructure in Maine by Type

Infrastructure Type	Number
Fire and Rescue Stations	842
Law Enforcement Agencies	146
Fire Departments	504

Sources: (National Fire Department Census, 2015) (BJS, 2011) (U.S. Bureau of Justice Statistics , 2011)

Table 6.1.1-6: First Responder Personnel in Maine by Type

First Responder Personnel	
Police, Fire and Ambulance Dispatchers	710
Fire and Rescue Personnel	4,912
Law Enforcement Personnel	7,384
Emergency Medical Technicians and Paramedics	1,730

Sources: (National Fire Department Census, 2015) (U.S. Bureau of Labor Statistics, 2015a) (BJS, 2011)

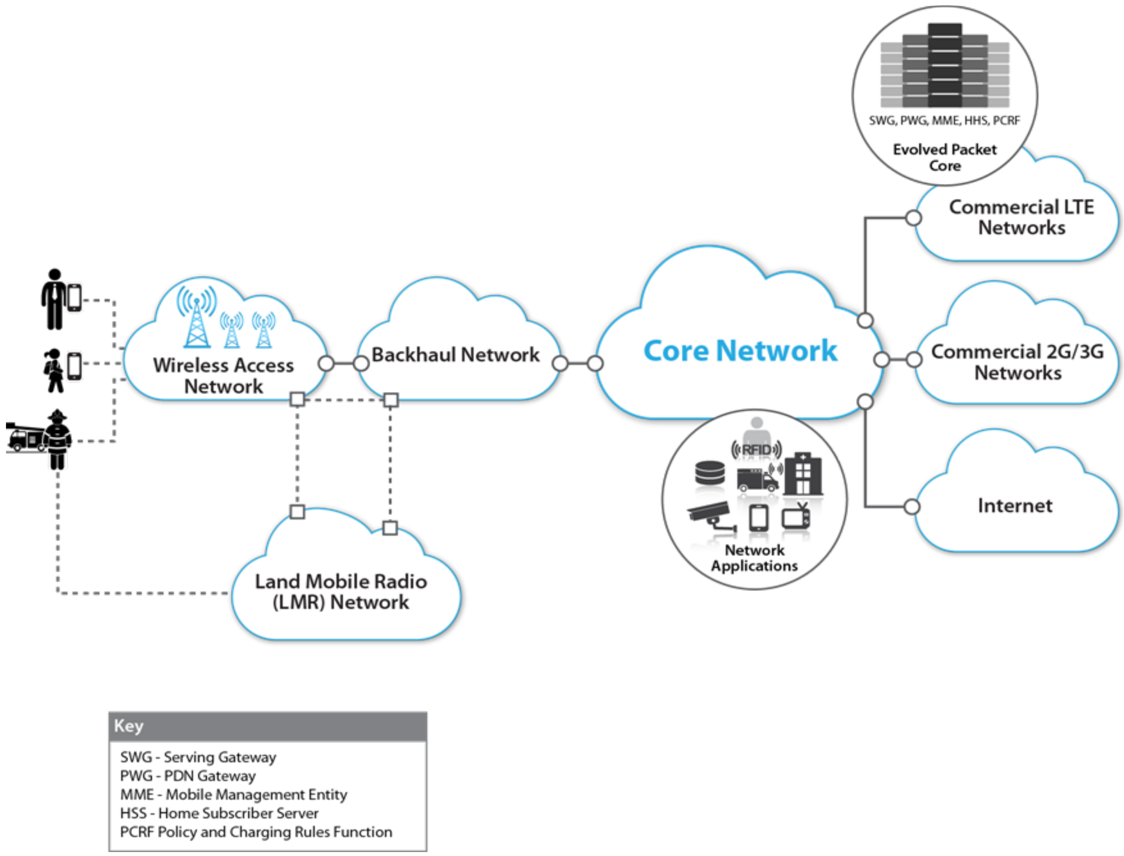
6.1.1.5 Telecommunications Resources

Telecommunication resources in Maine 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 Maine 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 6.1.1-2 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 a long term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as LTE (see Section 12.1.1), 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 also been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the U.S. and at the state level, including in Maine. (FCC, 2016a).



Prepared by: Booz Allen Hamilton

Figure 6.1.1-2: Wireless Network Configuration

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 with a nationwide public safety LTE broadband network, 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, forecast the evolution of LBS capabilities and gaps, and identify potential research and development opportunities that would improve the public safety community’s use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years to better inform investment decisions (PSCR, 2015).

Public safety communications in Maine are similar to those in other states, however there is very sparse geographical coverage in the more remote parts of the state; networks consist of a mix of older analog[2] across narrowband Very High Frequency (VHF)[3] and High and Low VHF. According to Maine's Statewide Communication Interoperability Plan (SCIP) Implementation Report: "Eight of nine state agencies using radios in Maine use VHF high-band. The ninth agency, the Department of Transportation, uses VHF low-band. With the exception of the City of Portland, which uses 800 megahertz (MHz), all non-state users are on VHF high-band. As a result, there is almost universal use of VHF high-band frequencies." (State of Maine, 2012).

One distinguishing feature in Maine is that it shares a border with Canada, which requires special treatment regarding public safety communications coordination, including unique frequency coordination challenges. The state's SCIP summarizes this challenge as follows: "Maine shares 184 miles of border with the state of New Hampshire, over 600 miles with Canada, and over 33 thousand square miles of diverse geography. Due to these factors, communications are impacted at various levels of government, non-government, local, county, and state resources. One issue that complicates interoperable communications in Maine is the "Line A" demarcation which cuts the state approximately in half. "Line A" essentially follows U.S. Route 2 from the Bethel (western Maine) area across the state to Bangor, where the Line then follows south down Interstate 395 to the mid-coast town of Belfast. The "Line A" demarcation in essence is 163 land miles long and stretches 200 more miles into the Atlantic Ocean. All communities north and east of "Line A" must ensure that communications frequencies do not interfere with any communications across the border in Canadian Provinces." (State of Maine, 2012)

In Maine, the central authority over the Maine state Communications Network (MS CommNet) lies within the Maine Office of Information Technology (OIT). Local agencies also operate their own VHF RegionNet system. (Radio Services Operations Department State of Maine, 2015)

The governance of interoperability requirements and implementation is a shared, cross-organizational accountability, summarized by Maine's 2012 SCIP as follows: "The Maine Interoperable Communications Committee (MICC), the Statewide Radio Network Board, and the SCIP Working Group currently compose Maine's governance structure. Created to develop Maine's plan for statewide voice and data communications, the MICC now serves as the governing body for the State's SCIP. The Statewide Radio Network Board handles the replacement/upgrade, acquisition, and expansion of the statewide radio network system used by state agencies with the potential expansion to non-state organizations. Maine relies on a series of formal and informal Mutual Aid Agreements (MAAs) and Memoranda of Understanding (MOUs) at all levels and across various functional areas so that the state, its various jurisdictions, regional neighbors, and the private sector can share resources during emergencies. These Memorandum of Agreements generally support all hazards and all resources type of response. The one communications-specific agreement is the Concept of Operations (CONOPS) Plan for frequency sharing and allocation." (State of Maine, 2012)

The public safety and Maine state agency wireless network operates on 40 wireless tower sites with equipment that supports both digital (P-25) and analog services (Maine OIT, 2014). In

[2] Analog networks are those based on circuit-switching, which establishes a connection and then maintains it through the whole communication. Although now digitized, the nation's original telephone system is an example of an analog network.
[3] VHF band covers frequencies ranging from 30 MHz to 300 MHz (NTIA, 2005).

2015, Maine completed the upgrade of its wireless statewide infrastructure to P-25. The new radio communications network provides access statewide to Maine government and state agencies providing "redundancy, high availability, and assured communications" with a modernized radio network (Maine OIT, 2015a).

Regional Networks

Operating on traditional narrowband VHF frequencies and supported by analog repeaters located on towers throughout the state, Maine's RegionNet supports municipal, county, tribal, adjacent state, and province users as well as federal public safety agencies and the Maine National Guard (Maine OIT, 2015b). RegionNet provides two services at each of the 40 tower sites: (1) two-way (interoperable) land mobile VHF communications between state and local agencies, and (2) Zone Dispatch Broadcast Service. State enabled communications between digital agencies operate within MS CommNet and local agencies operate within their own systems. State-provided RegionNet repeaters provide communication between MS CommNet digital radios and other analog radio systems. At 16 of the 40 sites, Zone Dispatch is rebroadcasted or transmitted from the digital MS CommNet repeaters through its sister RegionNet analog VHF repeater (Maine OIT, 2015b).

Public Safety incident management is based on Maine's CONOPS procedures managed by the Maine Emergency Management Agency (MEMA). An incident commander may request a "CONOPS authorization" if multiple criteria are met such as "a response from at least three levels of government and has a projected duration of 6 or more hours." (Radio Services Operations Department State of Maine, 2015)

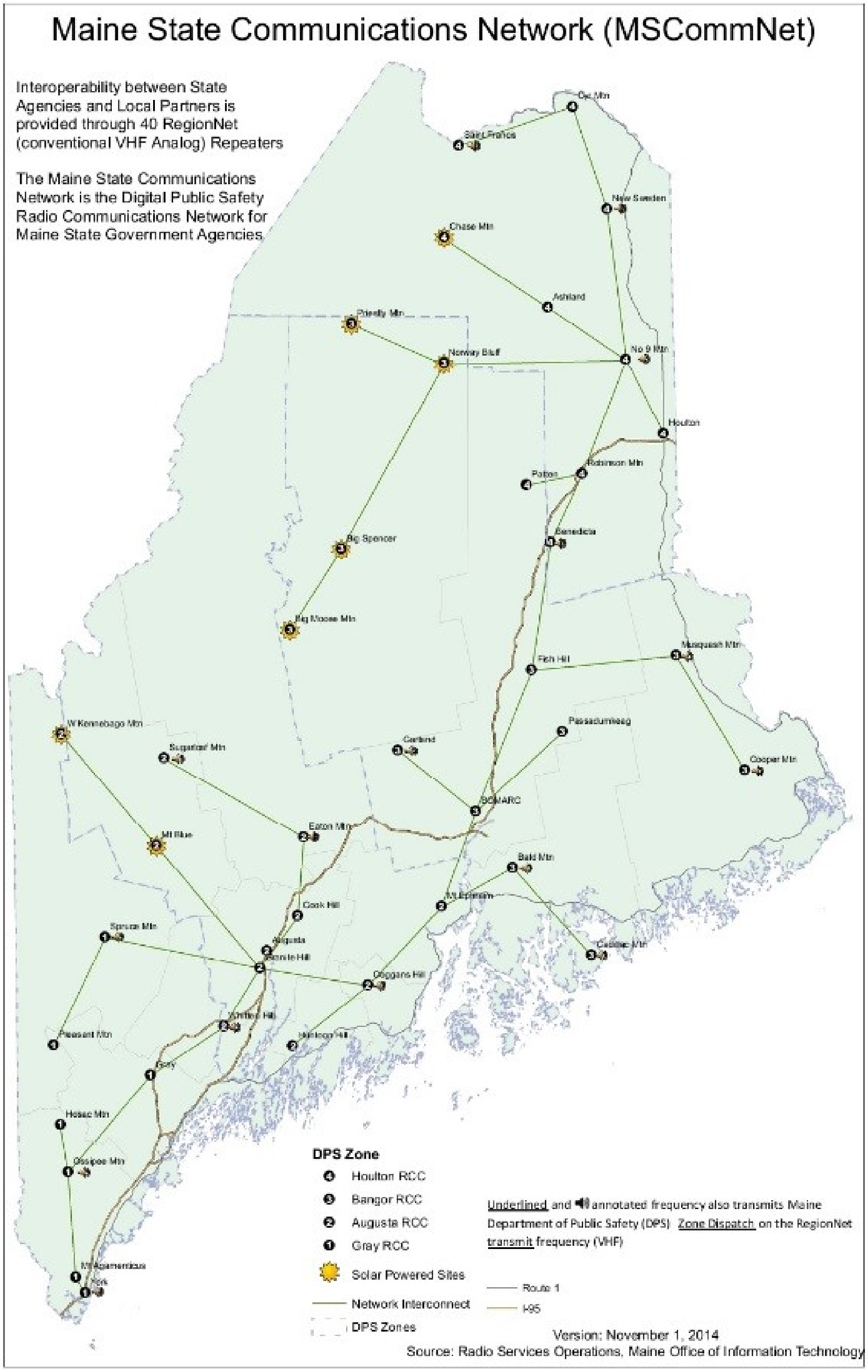
CONOPS VHF frequency agencies, and user groups approved under the CONOPS, use Simplex[4] frequencies, including: Statewide State Police (SWSP); Nationwide Car-to-Car Calling (NWCC); Emergency Medical Services (EMS)/Land Air Search and Rescue (LASER); State Police Car-to-Car (SPCC); State Fire; Statewide Car-to-Car (SWCC); VHF mutual aid calling (VCALL); and Tactical Communications. (Radio Services Operations Department State of Maine, 2015)

Public Safety Answering Points (PSAPs)

There are presently 26 Public Safety Answering Points (PSAPs) in Maine providing 9-1-1 and Next-Generation 9-1-1 (NG 9-1-1)[5] emergency call response service in the state. Each PSAP in the state has between 2 and 12 Answering Position Unit consoles to respond to wireless and wireline calls (State of Maine Emergency Services Communication Bureau, 2015). Responsibility for management of the Maine PSAPs resides with the Maine Emergency Service Communication Bureau.

[4] Line of sight, not repeated communications.

[5] An initiative in the U.S. and Canada to upgrade 9-1-1 infrastructure to support advanced emergency communications including text, video, image and data transmission to PSAPs from the public.



Source: (Radio Services Operations Department State of Maine, 2015)

Figure 6.1.1-3: MSCommNet Sites

Commercial Telecommunications Infrastructure

Maine's commercial telecommunications industry and infrastructure has multiple service providers, which offer products and services via the full spectrum of telecommunications technologies (FCC, 2014a) (FCC, 2014b). The following sub-sections present information on Maine's commercial telecommunications infrastructure, including 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

By providing coaxial cable, fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems as well as cable submarine systems for international connectivity, Maine's commercial telecommunications industry covers the full spectrum of telecommunications technologies and networks. Table 6.1.1-7 presents the number of providers of switched access[6] lines, Internet access[7], and mobile wireless services including coverage.

Table 6.1.1-7: Telecommunications Access Providers and Coverage in Maine, as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage
Switched access lines	86	97.6% of households
Internet access	28	67% of households
Mobile Wireless	5	90% of population

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

Table 6.1.1-8 shows the wireless providers in Maine along with their geographic coverage. The following four maps, Figure 6.1.1-4 to Figure 6.1.1-7, present coverage by Lightyear Network Solutions and U.S. Cellular; coverage by AT&T and Verizon; coverage by Sprint, Premium Choice Broadband, and Pioneer Wireless, Inc.; and coverage by other providers.

Table 6.1.1-8: Wireless Telecommunications Coverage by Providers

Wireless Telecommunications Providers	Coverage
Lightyear Network Solutions	52.38%
Verizon Wireless	52.38%
AT&T Inc.	45.20%
U.S. Cellular	28.57%
Premium Choice Broadband	23.35%
Pioneer Wireless, Inc.	7.56%
Sprint Nextel Corporation	7.46%
Other[a]	28.23%

[a]Other: Provider with less than 5% coverage area. Providers include: Axiom Technologies, RedZone Wireless, Biddeford Internet Corporation, Aroostook Technologies, Inc., Hussey Communications, TMobile Wireless, Bluestreak, Chebeague.net.

Source: (NTIA, 2014)

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

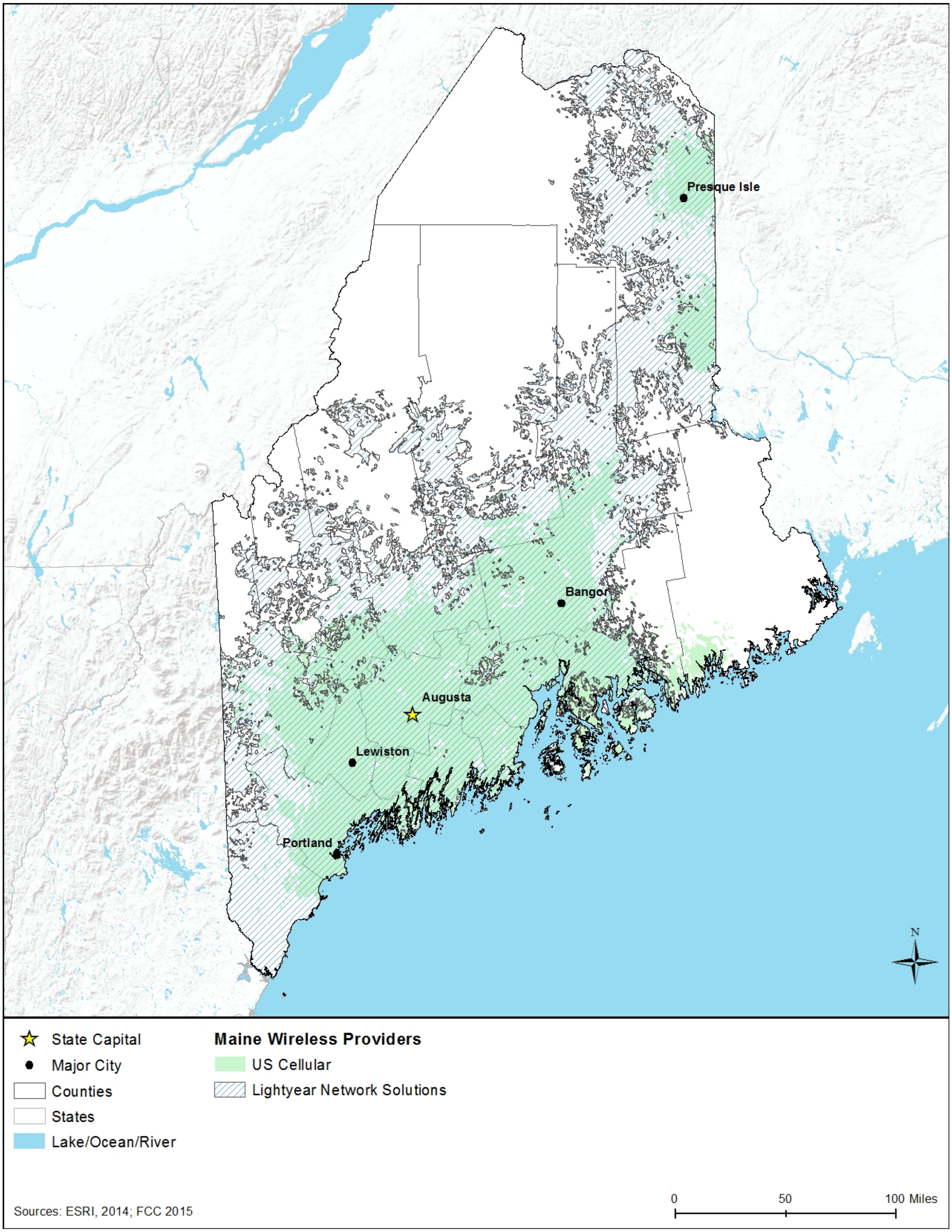


Figure 6.1.1-4: Lightyear Network Solutions and U.S. Cellular Wireless Availability in Maine

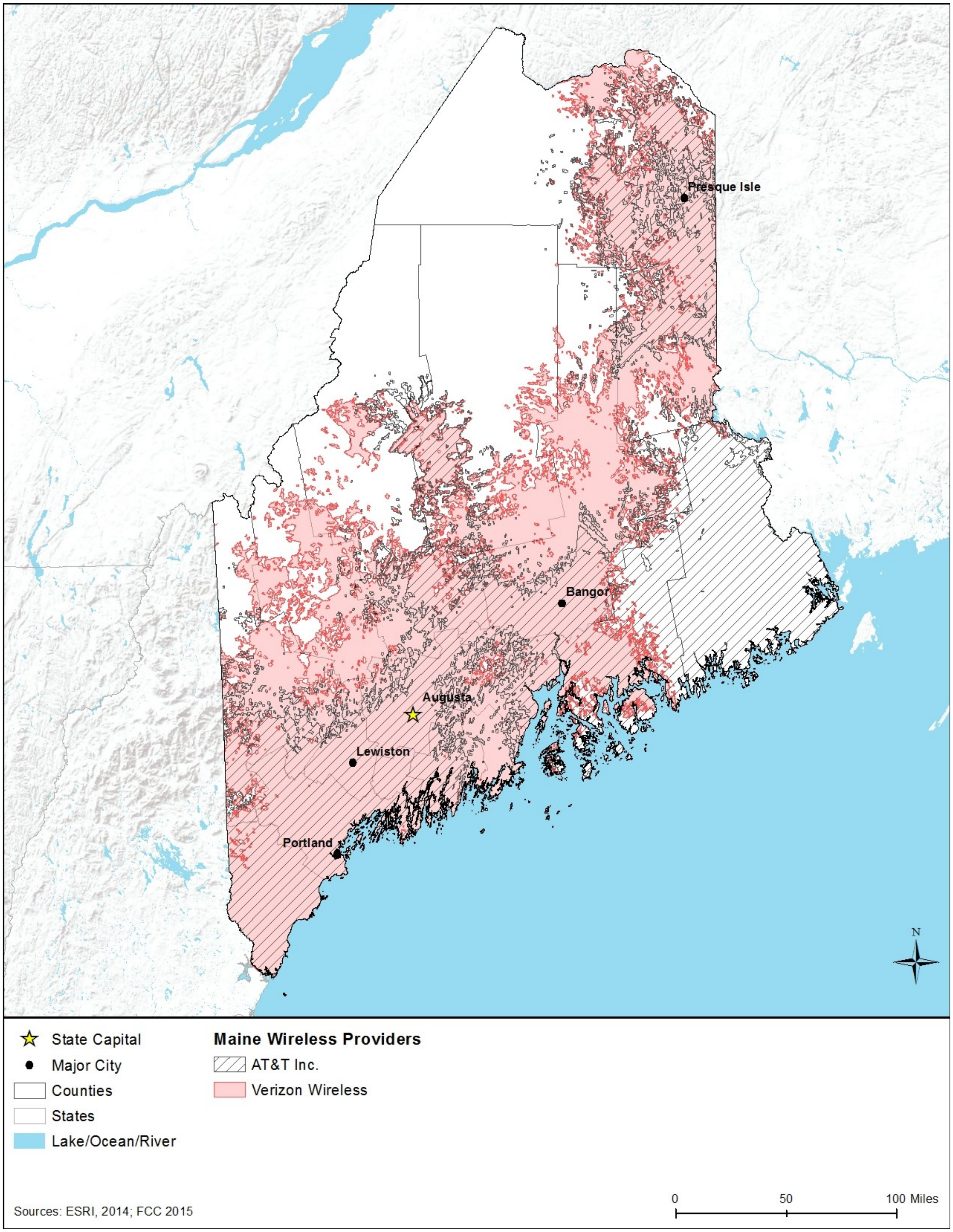


Figure 6.1.1-5: AT&T and Verizon Wireless Availability in Maine

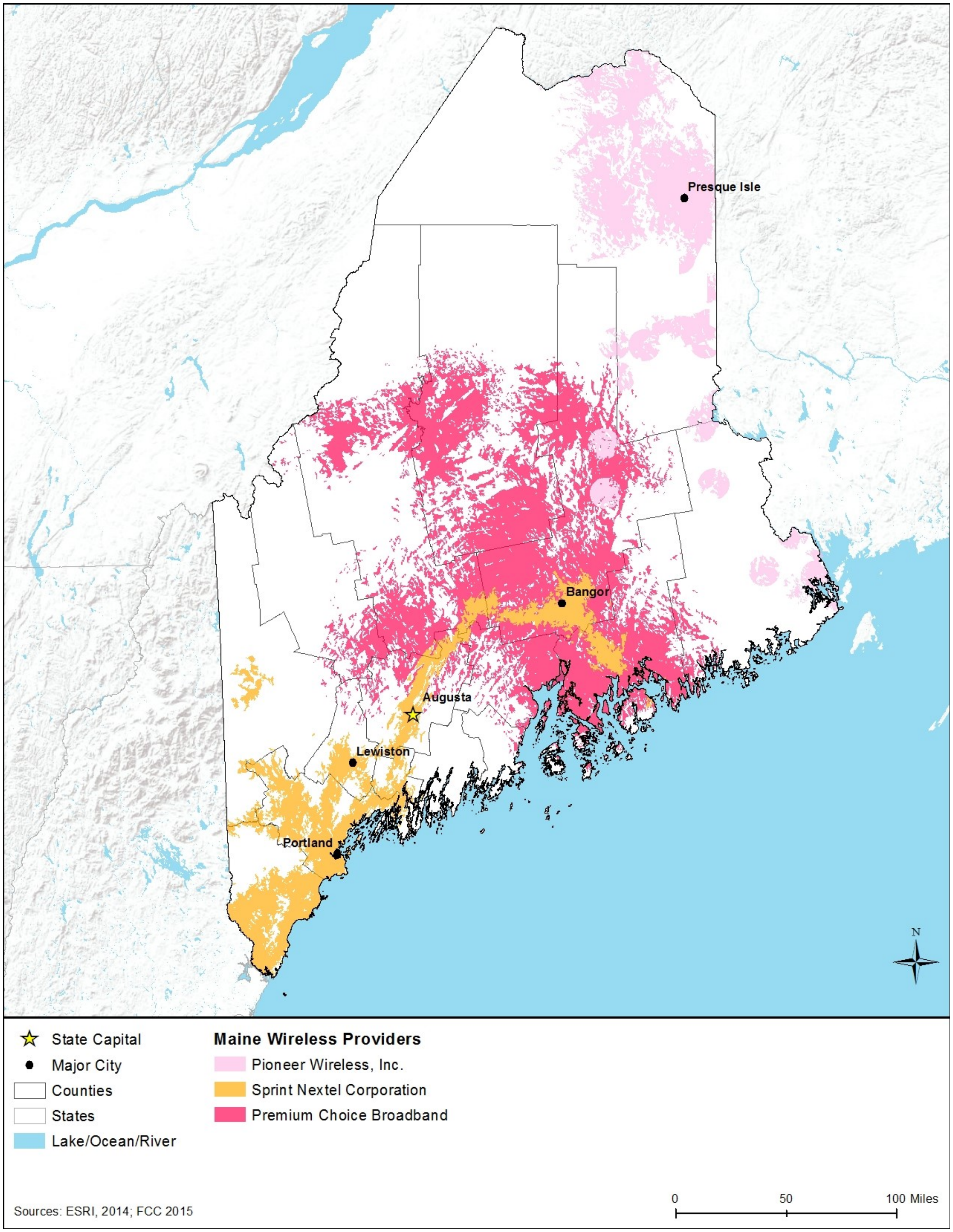


Figure 6.1.1-6: Sprint, Premium Choice Broadband, and Pioneer Wireless, Inc. Wireless Availability in Maine

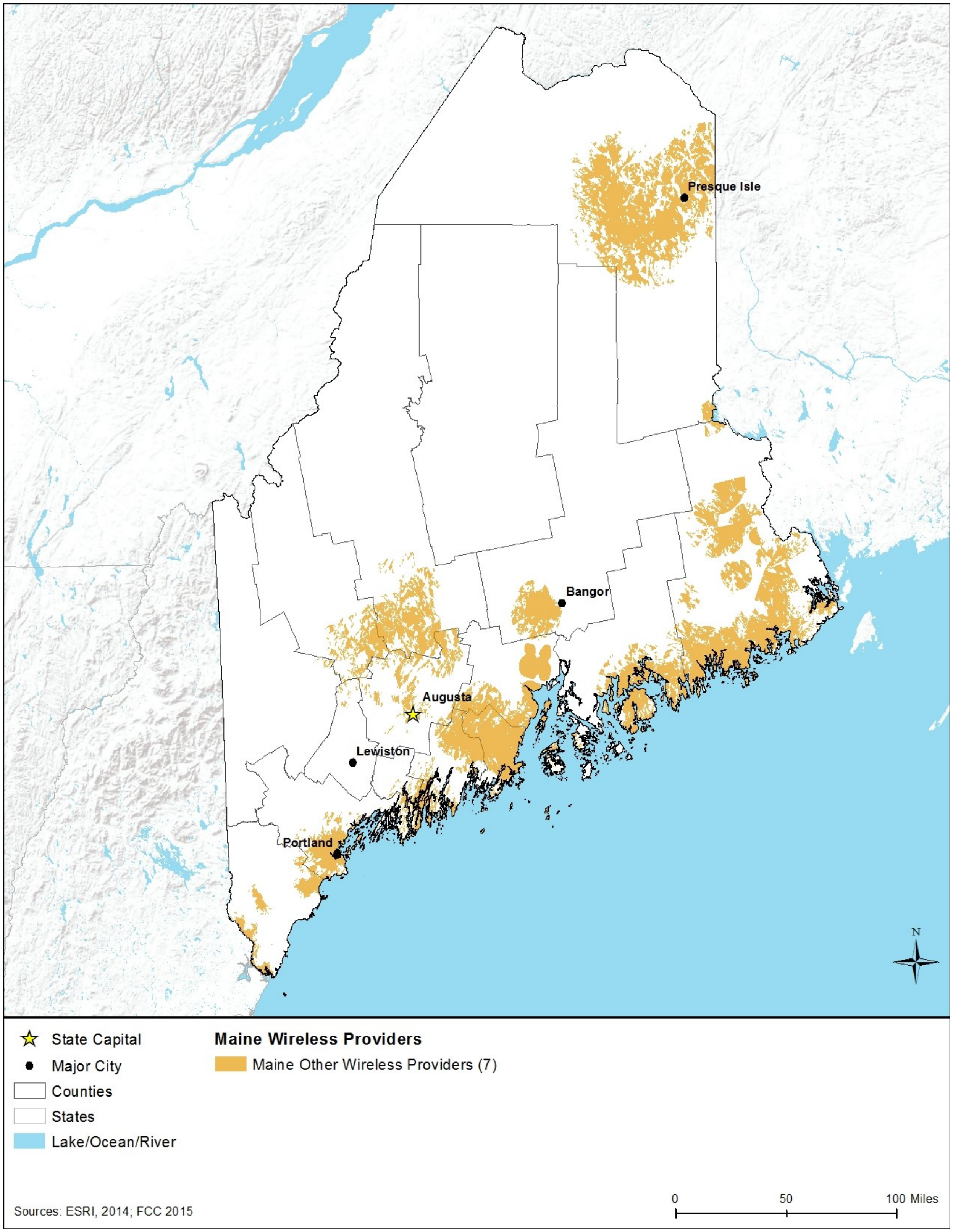


Figure 6.1.1-7: Other Wireless Providers' Availability in Maine

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 6.1.1-8 presents representative examples of each of these categories or types of towers.

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

Lattice
200 – 400 feet
Source: Personal Picture

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

Figure 6.1.1-8: Types of Towers

Telecommunications tower infrastructure in Maine is primarily concentrated in the higher and more densely populated areas along the coast. Figure 6.1.1-9 shows the location of those 541 structures, as of June 2015. Owners of towers and some types of antennas are required to register those infrastructure assets with the Federal Communications Commission (FCC) (FCC, 2016b) [8]. Table 6.1.1-9 shows the number of towers (including broadcast towers) registered with the FCC in Maine.

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

Table 6.1.1-9: Number of Commercial Towers in Maine by Type

Constructed[a] Towers[b]		Constructed Monopole Towers	
100ft and over	47	100ft and over	0
75ft – 100ft	114	75ft – 100ft	0
50ft – 75ft	191	50ft – 75ft	6
25ft – 50ft	90	25ft – 50ft	3
25ft and below	26	25ft and below	3
Subtotal	**468**	**Subtotal**	**12**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	8	100ft and over	0
75ft – 100ft	5	75ft – 100ft	0
50ft – 75ft	7	50ft – 75ft	1
25ft – 50ft	5	25ft – 50ft	1
25ft and below	0	25ft and below	1
Subtotal	**25**	**Subtotal**	**3**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	4	100ft and over	0
75ft – 100ft	11	75ft – 100ft	0
50ft – 75ft	12	50ft – 75ft	0
25ft – 50ft	4	25ft – 50ft	0
25ft and below	1	25ft and below	0
Subtotal	**32**	**Subtotal**	**0**
Constructed Tanks[d]			
Tanks	1		
Subtotal	**1**		
Total All Tower Structures		**541**	

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

Source: (FCC, 2015b)

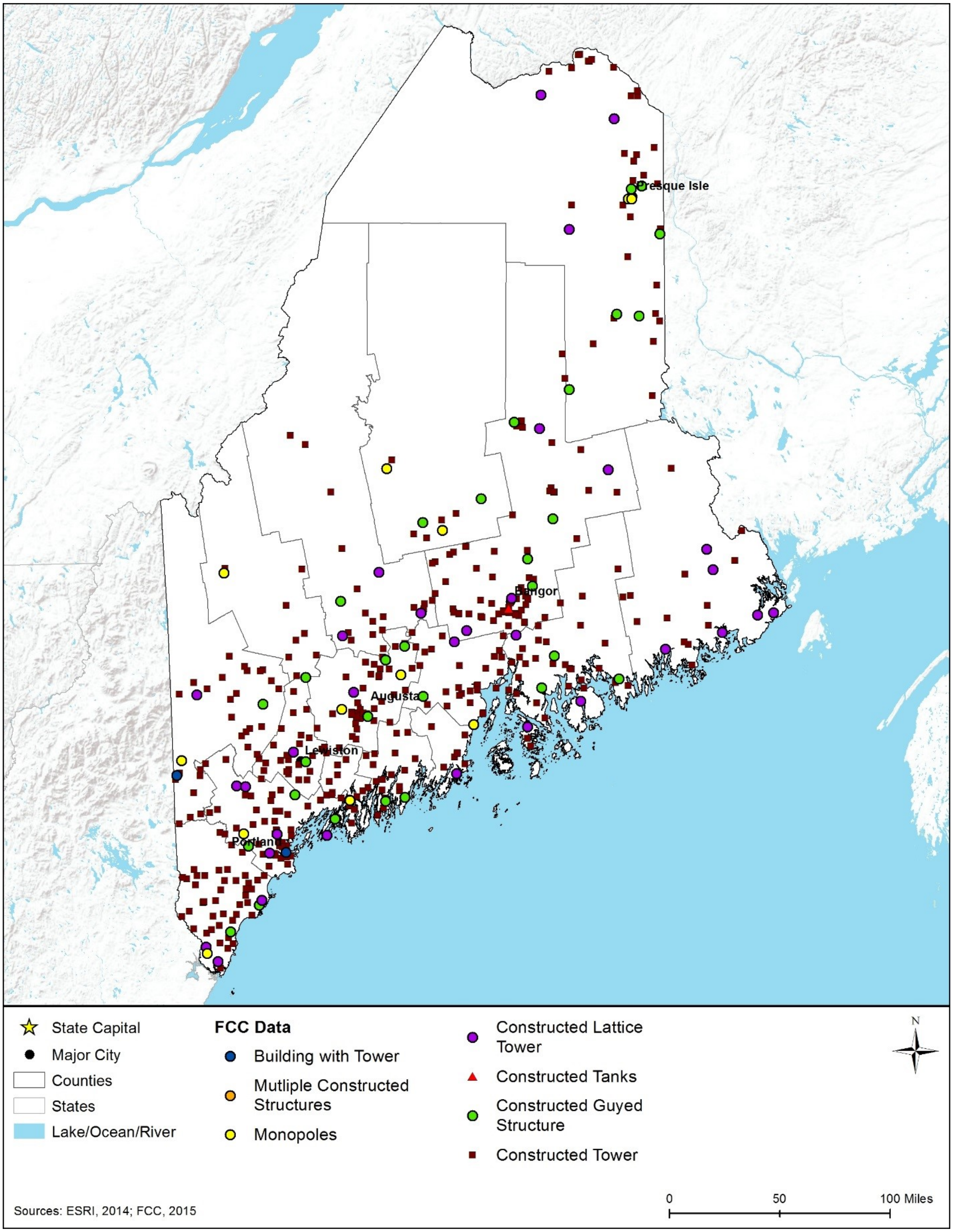
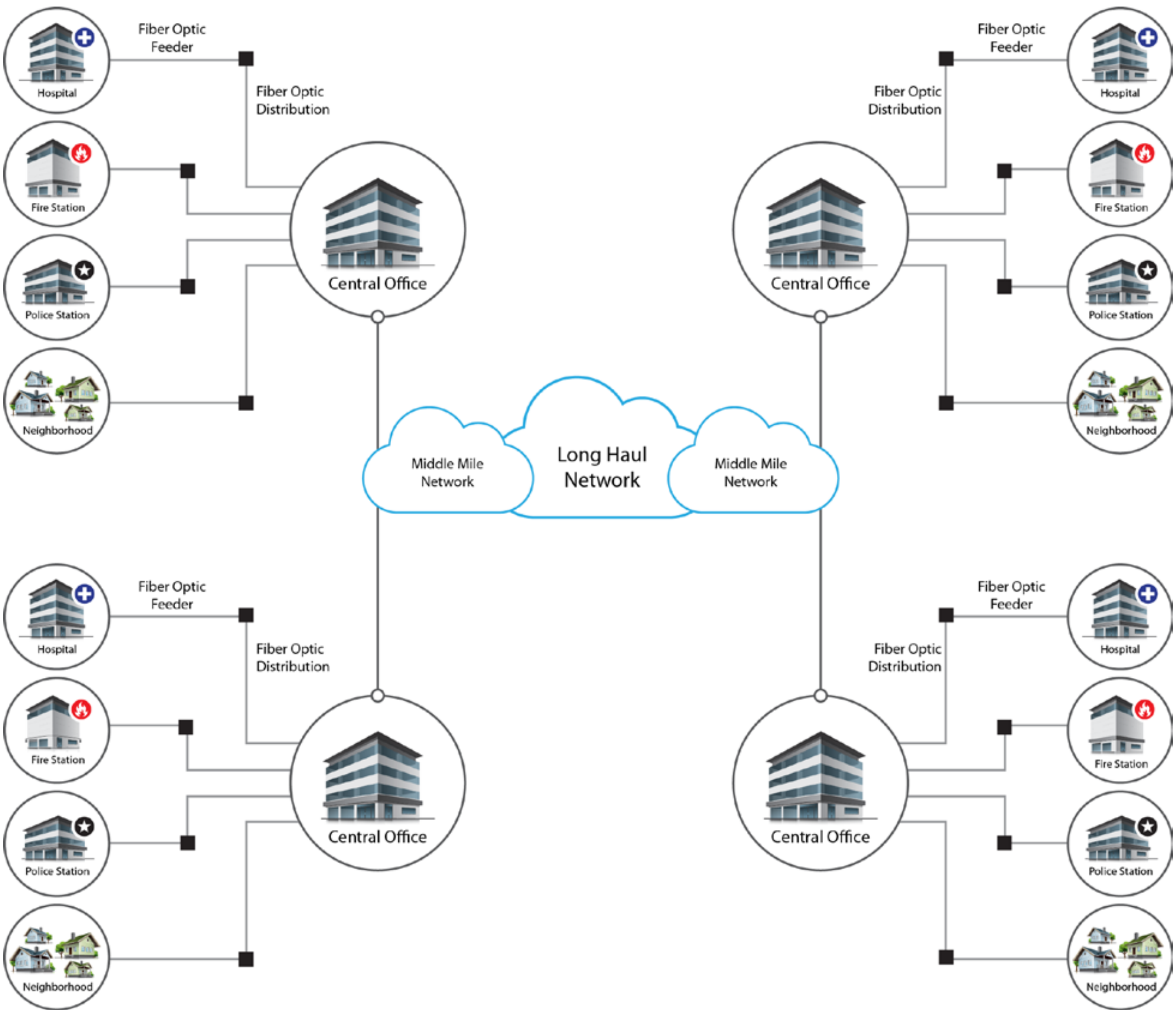


Figure 6.1.1-9: FCC Tower Structure Locations in Maine

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 6.1.1-10. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).



Prepared by: Booz Allen Hamilton

Figure 6.1.1-10: Typical Fiber Optic Network in Maine

Last Mile Fiber Assets

In Maine, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Maine there are 24 fiber providers that offer service in the state, as listed in Table 6.1.1-10. Figure 6.1.1-11 shows coverage for FairPoint Communications and Axiom Technologies; Figure 6.1.1-12 shows coverage for Time Warner Cable; and Figure 6.1.1-13 shows coverage for Biddeford Internet Corporation and other providers.

Table 6.1.1-10: Fiber Provider Coverage

Fiber Provider	Coverage
FairPoint Communications, Inc.	20.91%
Time Warner Cable	18.75%
Axiom Technologies	16.80%
Biddeford Internet Corporation	5.44%
Other[a]	25.15%

[a]Other: Provider with less than 5% coverage area. Providers include: Otelco, Inc., Comcast, Oxford Telephone and Telegraph, Christian Hill Farm, Inc., Lincolnville Telephone Company, TDS Telecom, Unitek, Inc., Harron Communications LP, Bee Line Inc., Union River Telephone Company, Xpress America Internet, NEPSK, Inc., Megapath, Inc., North Country Broadband, One Communications Corporation, Networkmaine, Chebeague.net, New Edge Holding Company, and Level 3 Communications, LLC.
Source: (NTIA, 2014)

Data Centers

Data centers (also known as network access points, collocation facilities, hosting centers, carrier hotels, and Internet exchanges) are large telecommunications facilities that house routers, switches, servers, storage, and other telecommunications equipment. These data centers facilitate efficient network connectivity among and between telecommunications carriers and between carriers and their largest customers. These facilities also provide racks and cages for equipment, power and cooling, cabling, physical security, and 24x7 monitoring (CIO Council, 2015; GAO, 2013).

6.1.1.6 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 6.1.4, Water Resources, describes the potable water sources in the state.

Electricity

Electricity utilities in Maine are regulated by the Maine Public Utilities Commission (MPUC). Any retail electricity supplier, aggregator, or electricity broker company wishing to provide services has to be licensed by the Commission. Transmission of electricity through transmission or distribution lines can only be completed by licensed companies (MPUC, 2015a). Customers in the state get their electricity through three major retailers: Central Maine, Bangor Hydro, and

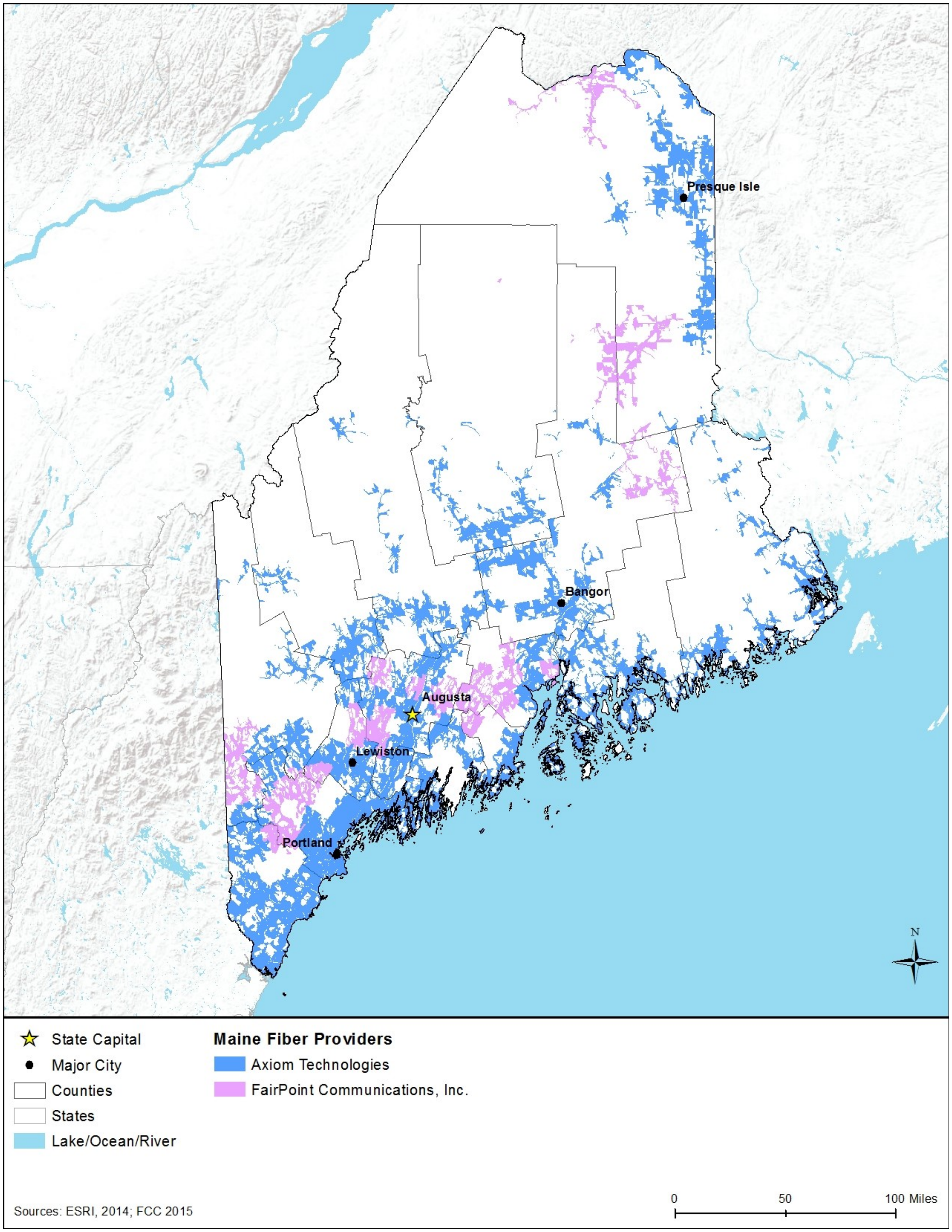


Figure 6.1.1-11: FairPoint Communications and Axiom Technologies Fiber Availability in Maine

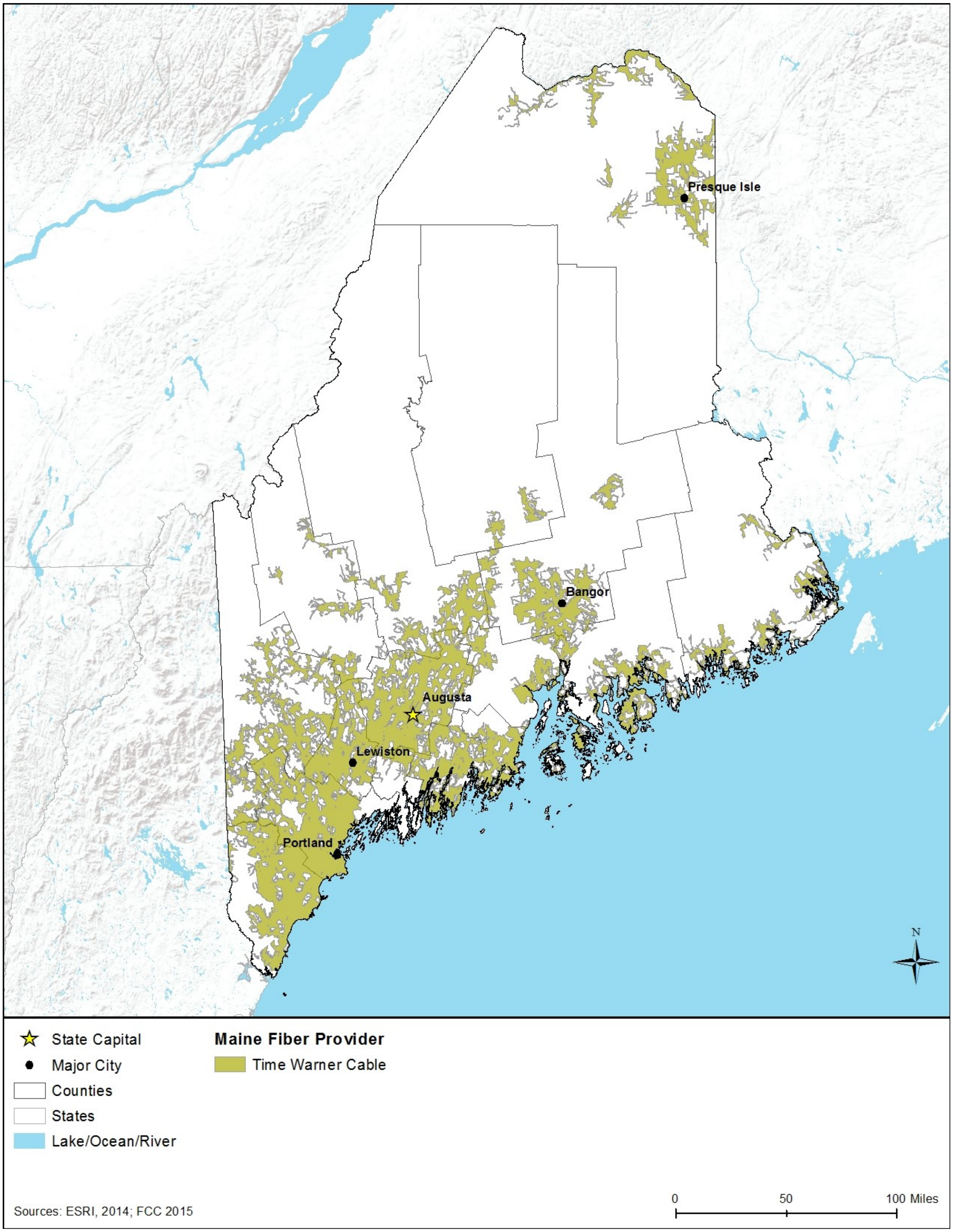


Figure 6.1.1-12: Time Warner Cable Fiber Availability in Maine

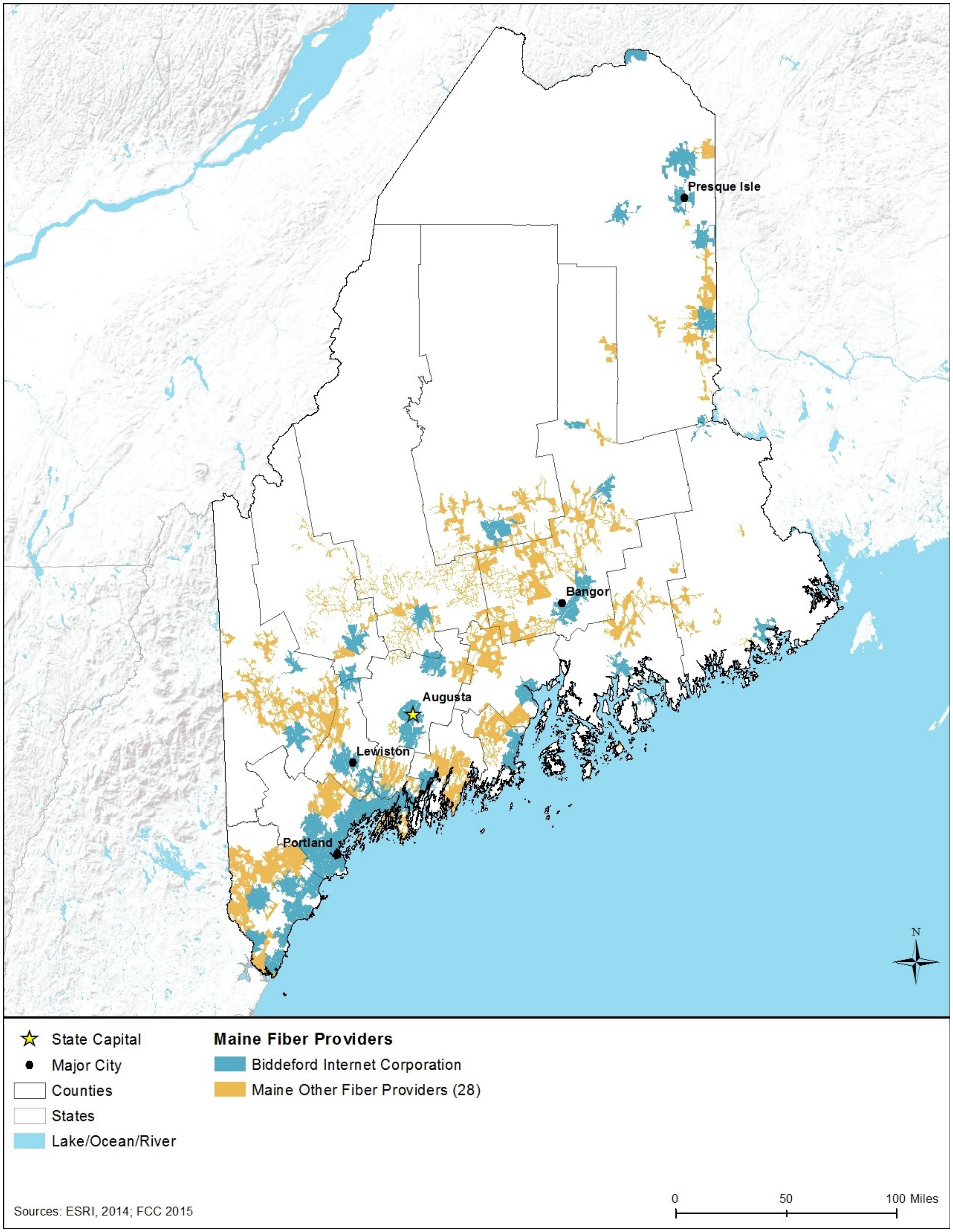


Figure 6.1.1-13: Biddeford and Other Provider Fiber Availability in Maine

Maine Public. Both Bangor Hydro and Maine Public are owned by Elmera Maine. These three utilities supply power to residential and commercial electricity brokers (MPUC, 2015b). Of these, Central Maine supplies 373 aggregators and 103 suppliers. Central Maine also sells electricity to 13 companies that are designated as both aggregators and suppliers.

Bangor Hydro covers 444 aggregators and 111 suppliers, as well as 15 companies that fall into both categories. A total of 356 aggregators, 69 suppliers, and 6 aggregator/supplier companies are themselves supplied by Maine Public. Many of these companies supply customers in multiple districts, meaning that one company can receive electricity from more than one of these retailers. For example, C.N. Brown Electricity, LLC operates in the districts of both Central Maine and Bangor Hydro (MPUC, 2015b). By the end of 2014, Maine had the lowest average electricity prices in New England, with three fifths of their net generation coming from renewable sources. Of this, a quarter came from hydroelectric sources and another 27 percent from biomass. By April 2015, Maine had produced 182 Gigawatt-hours (GWh) of electricity from natural gas, 307 GWh from hydroelectric, and 353 GWh from renewable sources (EIA, 2015a)[9].

Water

Maine's water utilities are governed in part by the MPUC, which ensures that service rates are fair to both consumers and the utility company (MPUC, 2015c). A total of 155 utilities have their rates regulated by the MPUC. Of these 155 utilities, nine are divisions of Maine Water, such as the Camden Division or the Greenville Division, though their rates are regulated individually (MPUC, 2015d). The state's public water systems are overseen by the Maine Drinking Water Program. It is the responsibility of the Drinking Water Program to monitor and manage systems, as well as ensure that public drinking water is treated and protected. All public water systems must be tested yearly, with dates assigned via a sampling schedule that is mailed to all public water systems at the start of each year. Any water system that ads chemicals to their water must submit reports monthly to the Drinking Water Program. Any community public water system must complete a Consumer Confidence Report (CCR) each year, which is made public for consumer review (Maine DEH, 2015a).

Wastewater

While Maine's wastewater is managed on a municipal level instead of a state level, the Maine Department of Environmental Protection's (DEP) Division of Water Quality Management offers technical review and assistance to wastewater treatment facilities. The DEP offers assistance in areas of process control, laboratory technique, lagoon sludge depth determination, detention time studies, secondary clarifier analyses, energy use analysis, assessing management and staffing requirements. The Division of Water Quality Management also offers technical review when a municipality seeks to expand its sewer system or its wastewater treatment plan (Maine DEP, 2015a). Decentralized in-ground wastewater systems, also known as septic systems, are commonplace in rural areas. The Subsurface Wastewater Team of the Division of

[9] One Gigawatthour can be defined as "One billion watthours," where one watthour is "the electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour." (EIA, 2015b).

Environmental Health is the ruling body that regulates subsurface sewage systems. It also authorizes licenses for people to evaluate soil, plumbing, and septic systems (Maine DEH, 2015b).

Solid Waste Management

The Maine DEP uses several programs to manage specific types of solid waste, such as scrap tires or electronics. They also manage solid waste facilities, such as landfills. Along with licensing and enforcement of regulations, the DEP also offers education programs in regard to waste disposal (Maine DEP, 2015b). The DEP licenses forty-two landfills across the state (Maine DEP, 2015c). They also offer electronic waste (e-waste) collection locations throughout the state where residents, schools, and small businesses can drop electronics off and have them recycled by the state at little to no cost (Maine DEP, 2015d). Batteries, cathode ray tubes, fluorescent bulbs, mercury thermostats, PCB ballast, vehicle switches, and other electronic devices are all accepted by state collection sites, though some may accept different materials than others (Maine DEP, 2015e).

6.1.2 Soils

6.1.2.1 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.

6.1.2.2 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 Section 1.8. A list of applicable state laws and regulations is included in Table 6.1.2-1.

Table 6.1.2-1: Relevant Maine Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Maine Erosion and Sediment Control Law (Title 38 M.R.S.A. Section 420-C)	Maine DEP	Construction projects of any size must have sediment control measures placed at the down gradient side of the construction site before work begins, and erosion control measures in place to permanently stabilize the site when construction is completed.

6.1.2.3 Environmental Setting

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

- Northeastern Forage and Forest Region

Within and among Maine's single LRR are four Major Land Resource Areas (MLRA),[11] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming. The locations and characteristics of Maine's MLRAs are presented in Figure 6.1.2-1 and Table 6.1.2-2, respectively.

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

[10] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (NRCS, 2006).
[11] Major Land Resource Area: "A geographic area, usually several thousand acres in extent, that is characterized by a particular pattern of soils, climate, water resources, land uses, and type of farming" (NRCS, 2006).
[12] The flora and fauna of a region.
[13] Expansive soils are characterized by "the presence of swelling clay minerals" that absorb water molecules when wet and expand in size or shrink when dry leaving "voids in the soil" (Rogers, Olshansky, & Rogers, 2004).
[14] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).

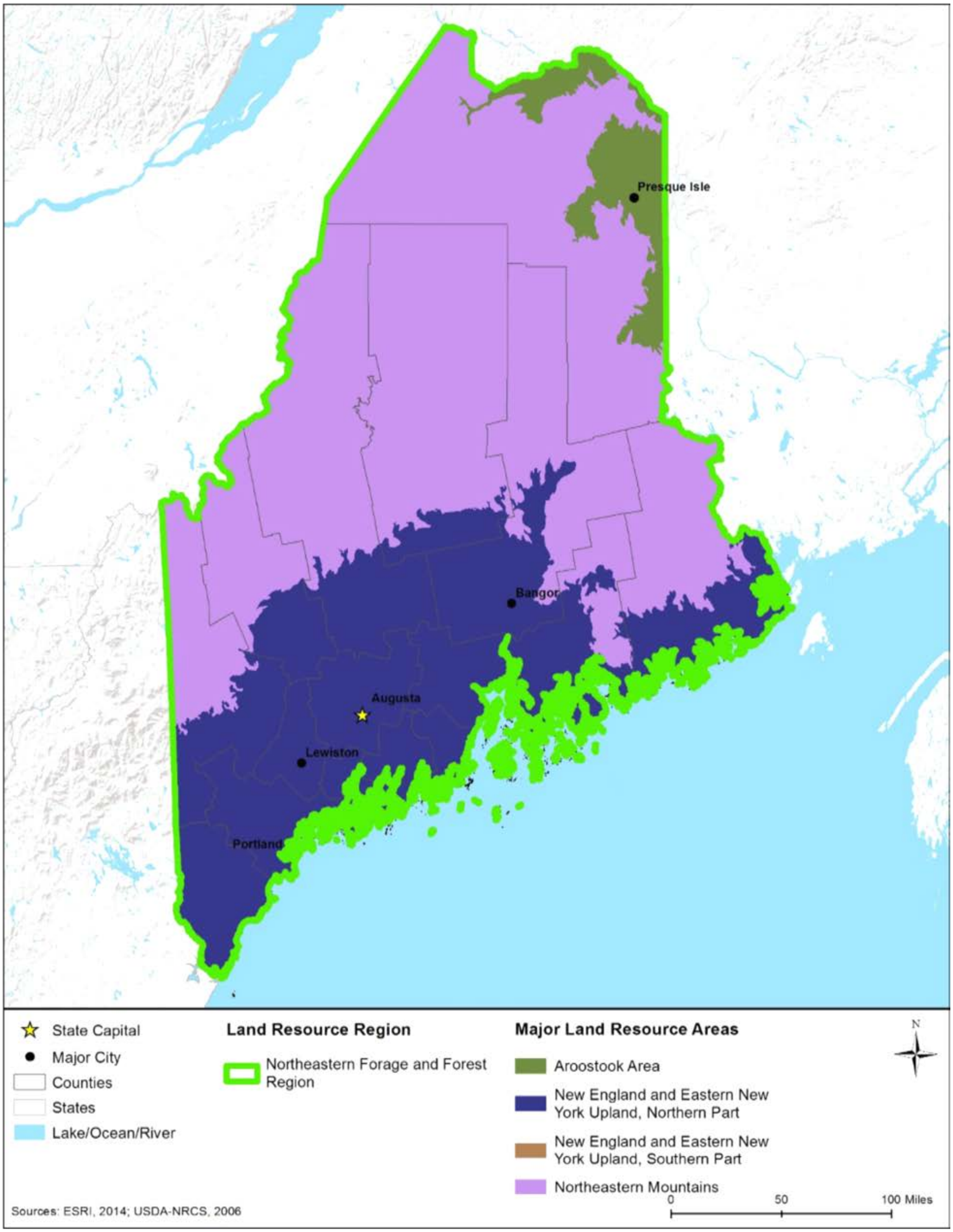


Figure 6.1.2-1: Locations of Major Land Resource Areas in Maine

Table 6.1.2-2: Characteristics of Major Land Resource Areas in Maine

MLRA Name	Region of State	Soil Characteristics
Aroostook Area	Northeastern Maine	Spodosols[15] and Inceptisols[16] are the dominant soil orders in this area, and the soils in this area are moderately deep to very deep, well drained to excessively drained, and loamy to sandy-skeletal
New England and Eastern New York Upland, Northern Part	Southern Maine	Dominant soil orders in this MLRA are Inceptisols and Spodosols, and the soils in this area are shallow to very deep, are generally excessively drained to poorly drained, and sandy or loamy.
New England and Eastern New York Upland, Southern Part	Southwestern Maine on the border of New Hampshire	The dominant soil orders in this area are Entisols,[17] Histosols,[18] and Inceptisols, and the soils in this area are very deep, somewhat excessively drained to poorly drained, and loamy or sandy.
Northeastern Mountains	Northern Maine	The dominant soil orders in this area are Inceptisols and Spodosols, and the soils are shallow to very deep, generally somewhat excessively drained to poorly drained, and are loamy.

Source: (NRCS, 2006)

6.1.2.4 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[19]; there are twelve soil orders in the world and they are characterized by both observed and inferred[20] 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, 2015b). The STATSGO2[21] soil database identifies ten different soil suborders in Maine (NRCS, 2015c). Figure 6.1.2-2 depicts the distribution of the soil suborders, and Table 6.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[15] Spodosols: "Soils formed from weathering processes that strip organic matter combined with aluminum from the surface layer and deposit them in subsoil. They commonly occur in areas of coarse-textured deposits under forests of humid regions, tend to be acid and infertile, and make up nearly 4% of the world's ice-free land surface" (NRCS, 2015d).
[16] 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, 2015d).
[17] 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, 2015d).
[18] 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, 2015d).
[19] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2015m).
[20] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)" (NRCS, 2015b).
[21] STATSGO2 is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map is comprised of general soil association units and is maintained and distributed as a spatial and tabular dataset.

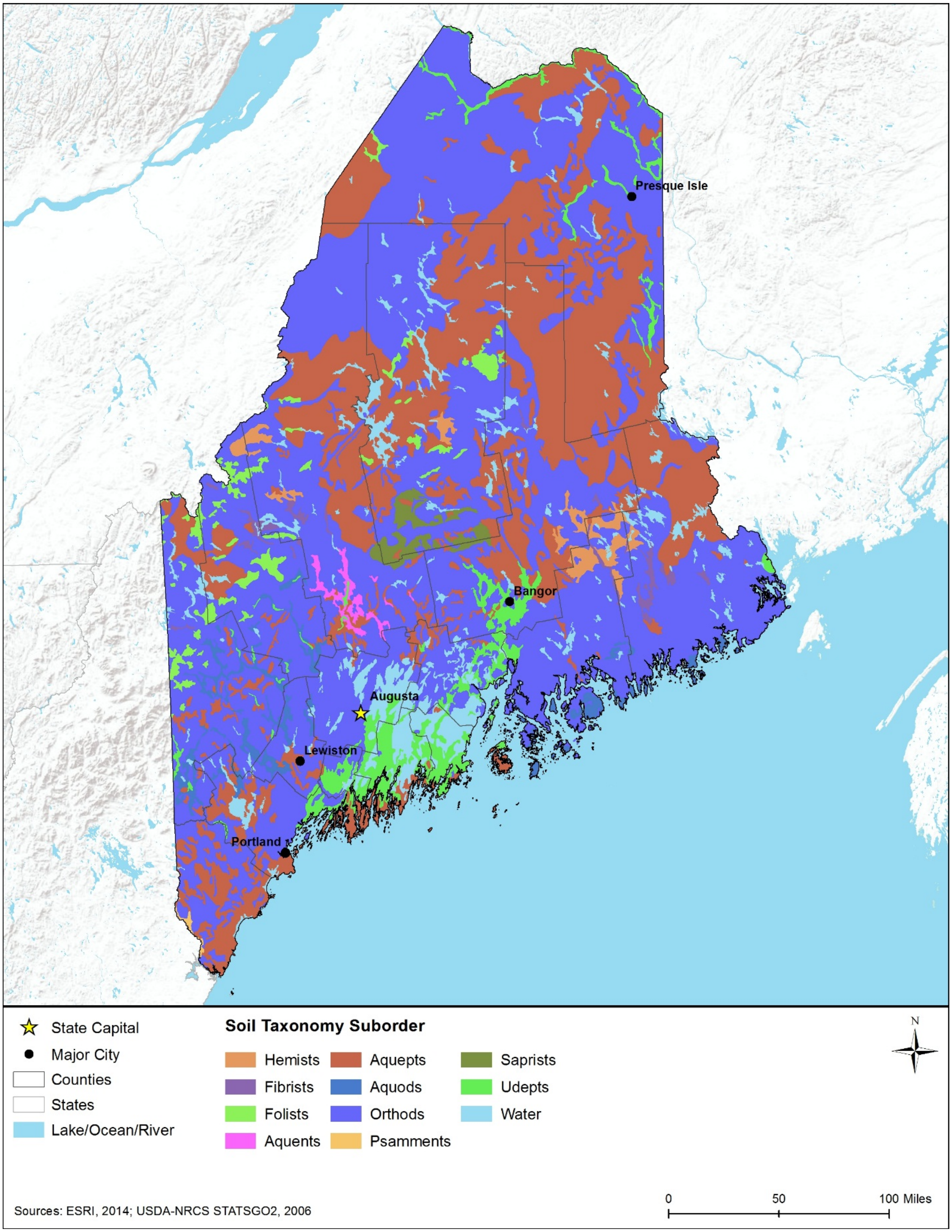


Figure 6.1.2-2: Maine Soil Taxonomy Suborders

6.1.2.5 Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[22] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 6.1.2-3 provides a summary of the runoff potential for each soil suborder in Maine.

Group A. Sand, loamy sand or sandy loam soils. This group of soils has "low runoff potential and high infiltration rates[23] 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). Folists, Orthods, and Psamments fall into this category in Maine.

Group B. Silt loam or loam soils. This group of soils has a "moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures" (Purdue University, 2015). This group has medium runoff potential. Orthods and Udepts fall into this category in Maine.

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. Aquents, Aquepts, Aquods, Orthods, and Udepts fall into this category in Maine.

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, Fibrists, Hemists, Orthods, and Saprists fall into this category in Maine.

6.1.2.6 Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015e). 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).

[22] 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.
[23] 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).

Table 6.1.2-3: Major Characteristics of Soil Suborders Found in Maine, as Depicted in Figure 6.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[24]	Hydrologic Group	Runoff Potential	Permeability[25]	Erosion Potential	Compaction and Rutting Potential
Entisols	Aquents	Aquents are wet Entisols, and are widely distributed. They are used mostly as pasture, cropland, forest, or wildlife habitat, and support vegetation that tolerates either periodic or permanent wetness.	Silt loam	0-2	Poorly drained	Yes	C	Medium	Low	Medium, depending on slope	High, due to hydric soil and poor drainage conditions
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage. If these soils have not been artificially drained, groundwater is at or near the soil surface at some time during normal years (although not usually in all seasons). They are used primarily for pasture, cropland, forest, or wildlife habitat. Many Aquepts have formed under forest vegetation, but they can have almost any kind of vegetation.	Channery silt loam, fine sandy loam, gravelly sandy loam, loam, muck, mucky peat, silt loam, silty clay, silty clay loam	0-8	Very poorly drained to somewhat poorly drained	No, Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Spodosols	Aquods	Aquods are wet Spodosols, characterized by a shallow fluctuating water table. Water-loving plants, ranging from moss, shrubs, and trees in cold areas to mixed forests and palms in the warmest areas, are the dominant vegetation. Most are used as wildlife habitat or forest, but some have been cleared and used as cropland or pasture.	Fine sandy loam, sand	0-3	Somewhat poorly drained	No, Yes	C	Medium	Low	Medium	High, due to hydric soil and poor drainage conditions
Histosols	Fibrists	Fibrists are slightly decomposed wet Histosols that support natural vegetation including shrubs, forbs, grasses, and widely spaced small trees.	Peat	0-1	Very poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Histosols	Folists	Folists mostly consist of horizons derived from leaf litter, twigs, and branches resting on bedrock or on fragmental materials. Most support forest vegetation, with some also supporting grass, or used for specialty crops or for urban or recreational development.	Peat, unweathered bedrock	0-80	Well drained	No	A	Low	High	Low	Low
Histosols	Hemists	Hemists are usually found in broad, flat areas, such as coastal plains and outwash plains as well as closed depressions. They are typically under natural vegetation and uses for rangeland, woodlands, and/or wildlife habitat, although some large areas have been cleared and drained, and utilized for cropland.	Mucky peat	0-1	Very poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Spodosols	Orthods	Orthods are relatively freely drained and with a moderate accumulation of organic carbon. They are mostly used for forest land or have been cleared and used as cropland or pasture.	Extremely gravelly coarse sand, fine sand, fine sandy loam, gravelly coarse sandy loam, gravelly fine sandy loam, gravelly sandy loam, gravelly silt loam, loam, loamy sand, sandy loam, silt loam, unweathered bedrock, very fine sandy loam, very gravelly coarse sand	0-50	Somewhat poorly drained to excessively drained	No	A, B, C, D	Low, Medium, High	Very Low, Low, Moderate, High	Low to High, depending on slope	Low

[24] Hydric Soil: "A soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (NRCS, 2015f).
[25] Based on Runoff Potential, described in Section 6.1.2.

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[24]	Hydrologic Group	Runoff Potential	Permeability[25]	Erosion Potential	Compaction and Rutting Potential
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	8-15	Excessively drained	No	A	Low	High	Low	Low
Histosols	Saprists	Saprists are wet Histosols, with well decomposed organic materials. They are used as woodland, rangeland, or wildlife habitat, and support natural vegetation. Those saprists in a warmer temperature regime are sometimes cleared and drained for use as cropland.	Muck	0-1	Very poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Inceptisols	Udepts	Udepts have a 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.	Silt loam, stratified sand and gravel to silt loam, very fine sandy loam	0-15	Moderately well drained to well drained	No	B, C	Medium	Moderate, Low	Medium	Low

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

Table 6.1.2-3 provides a summary of the erosion potential for each soil suborder in Maine. Soils with the highest erosion potential in Maine include those in the Aquents, Aquepts, Aquods, Fibrists, Hemists, Orthods, Saprists, and Udepts suborders, which are found throughout most of the state (Figure 6.1.2-2).

6.1.2.7 Soil Compaction and Rutting

Soil compaction and rutting occurs when soil layers are compressed by machinery or animals, which decreases both open spaces in the soil, as well as water infiltration rates (NRCS, 1996b). Moist soils with high soil water content are most susceptible to compaction and rutting, as they lack the strength to resist deformation caused by pressure. When rutting occurs, channels form and result in downslope erosion (USFWS, 2009). Other characteristics that factor into compaction and rutting risk include soil composition (i.e. low organic soil is at increased risk of compaction), amount of pressure exerted on the soil, and repeatability (i.e., the number of times the pressure is exerted on the soil). Machinery and vehicles that have axle loads greater than ten tons can cause soil compaction of greater than 12 inches (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 6.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Maine. Soils with the highest potential for compaction and rutting in Maine include those in the Aquents, Aquepts, Aquods, Fibrists, Hemists, and Saprists suborders, which are found throughout the state (Figure 6.1.2-2).

6.1.3 Geology

6.1.3.1 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 6.1.4), Human Health and Safety (Section 6.1.15, and Climate Change (Section 0).

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

- Section 6.1.3.3, Major Physiographic Regions and Provinces[26] [27]
- Section 6.1.3.4, Surface Geology
- Section 6.1.3.5, Bedrock Geology[28]

[26] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology (Fenneman, 1916).
[27] Physiographic provinces: Subsets within physiographic regions (Fenneman, 1916).
[28] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015a).

- Section 6.1.3.6, Paleontological Resources[29]
- Section 6.1.3.7, Fossil Fuel and Mineral Resources
- Section 6.1.3.8, Potential Geologic Hazards[30]

6.1.3.2 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 Section 1.8. A list of applicable state laws and regulations is included in Table 6.1.3-1.

Table 6.1.3-1: Relevant Maine Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Maine Uniform Building and Energy Code (2012)	Maine Bureau of Building Codes and Standards	Applies to all municipalities with 4,000 people or more, and includes seismic design standards.

Source: (Maine State Legislature, 2015)

6.1.3.3 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 more local scale. (Fenneman, 1916)

Maine is entirely within the Appalachian Highlands Physiographic Region and the New England Province (Figure 6.1.3-1). To characterize differences in physiography across the state and to better support PEIS tiering, the three physiographic sections of the New England Province in Maine are summarized below.

[29] Paleontology: "Study of life in past geologic time based on fossil plants and animals" (USGS, 2015b).
[30] 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).

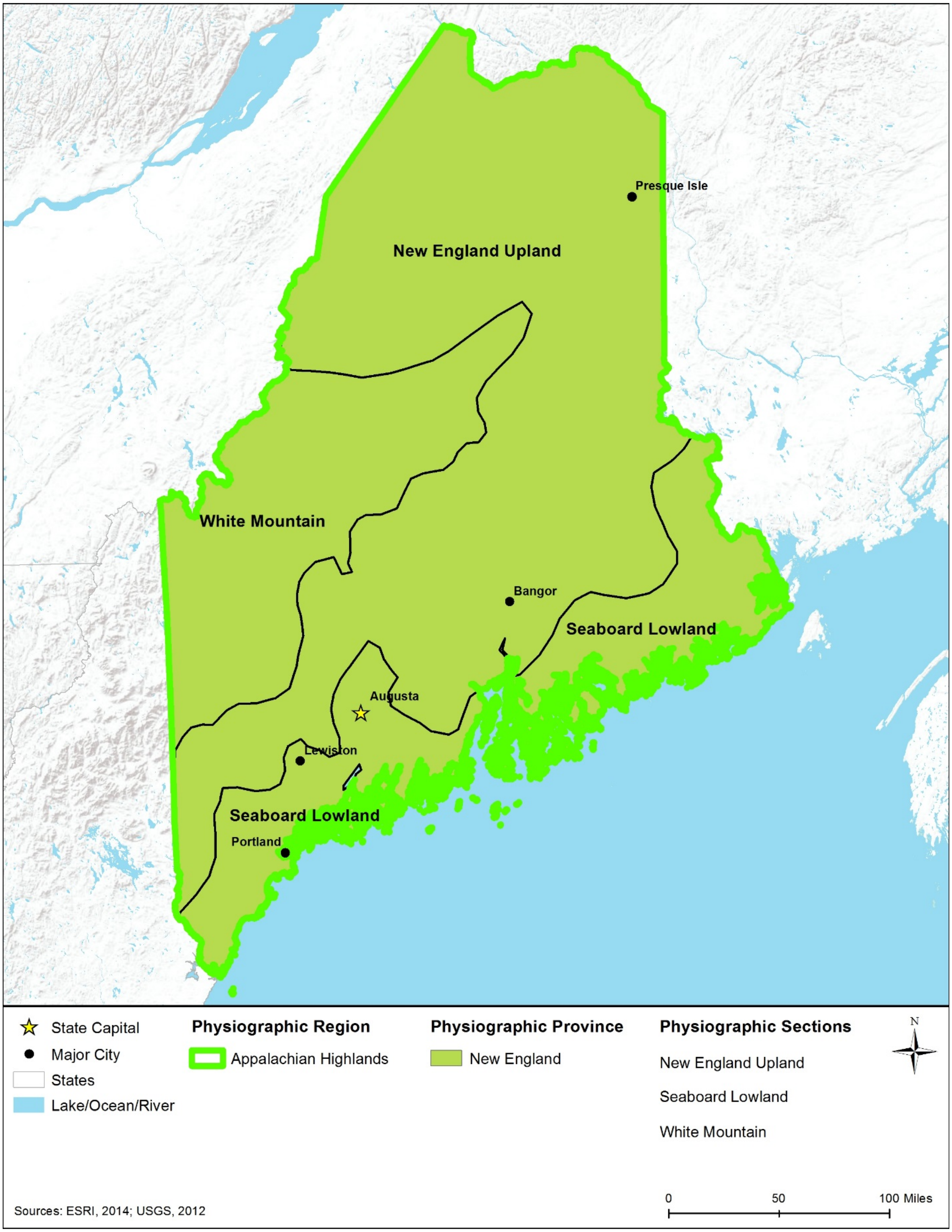


Figure 6.1.3-1: Physiographic Regions, Provinces, and Sections of Maine

Appalachian Highlands Region

The Appalachian Highlands Region extends from Canada to Alabama. This region is composed of layers of folded sedimentary rock,[31] created when the North American plates collided with the Eurasian and African plates more than 500 million years ago (MYA). Once similar in height to the present-day Rocky Mountains,[32] 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 Maine is composed of one physiographic province: the New England Province (USGS, 2003a).

<u>New England Province</u> **–** The New England Province spans between Canada and New Jersey. Topographically, the province is a broad plateau interspersed with narrow valleys. In Maine, there are three physiographic sections within the New England physiographic province: White Mountain, New England Upland, and Seaboard Lowland.[33] Each of these sections is discussed in greater detail below (USGS, 2003a).

White Mountain **–** The White Mountain section describe the area in western Maine that are above 1,500 feet ASL. The topography generally rises only 500 to 1,500 feet above the local landscape (USGS, 1999a). The White Mountains are separated from the New England Uplands to the east by a distinct ridge, which trends to the northeast along the entire length of the state (Toppan, 1935).

New England Upland **–** The New England Upland section is dominated by hills, which range from below 1,000 feet to above 2,000 feet ASL (USGS, 1999a). Hill slopes are generally gentle, though periodic sharp cliffs are encountered due to previous glacial activity. This section extends from the New Hampshire border in the south and merges with the Seaboard Lowlands section near the northern border (Toppan, 1935).

Seaboard Lowland **–** The Seaboard Lowland section spans the length of Maine's coast with varying widths, ranging from 20 miles in southern Maine to more than 70 miles in the northern portions of the state (Toppan, 1935). The Seaboard Lowland section is lower in elevation and less hilly than the New England Upland. The border of these two sections is between 400 and 500 feet ASL in most places. Topographic relief is below 200 feet in most places (USGS, 1999a). While the Seaboard Lowlands intersect on Maine's east coast with the Atlantic Ocean, the Seaboard Lowlands are not characterized as "coastal plain" (Toppan, 1935).

[31] 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, 2014e).
[32] The Rocky Mountains exceed 14,000 feet above sea level (NPS, 2004).
[33] The Toppan (1935) source classifies Maine's physiography into four sub-divisions: Central Lowlands, Central Uplands, Aroostook Valley, and Moosehead Plateau. Where this source is cited above, the Central Lowlands correspond to the Seaboard Lowlands, the Central Uplands and Aroostook Valley correspond to the New England Uplands, and the Moosehead Plateau corresponds to the White Mountains.

6.1.3.4 Surface Geology

Surficial geology is characterized by materials such as till,[34] 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,[35] subsidence,[36] and erosion. (Thompson W. , 2015)

Most of Maine was covered by glaciers during the most recent Pleistocene glaciation (between 25,000 and 13,000 years ago); the Laurentide Ice Sheet migrated toward the southeast past the present coastline. "The maximum thickness of the ice is uncertain, but it covered the highest mountains in Maine" (Thompson W. , 2015). As a result, much of the state is covered in glacial till (i.e., sediments) as indicated by Figure 6.1.3-2.

Glaciers eroded the bedrock surface throughout the White Mountains and removed rock fragments from Red Rock, Albany, and Square Dock Mountains, "leaving high cliffs on their southern and eastern sides." Rock fragments on the bottom of the glacier were dragged across the underlying bedrock. In some instances, glacial migration produced smooth surfaces on the bedrock, whereas parallel striations and broader grooves developed in other areas. As glaciers retreated 13,000 years ago, sediments were deposited, generally in greater concentrations at the bases of mountains and in more sporadic concentrations at higher elevations. (Maine Geological Survey, 2003)

The Laurentide Ice Sheet compressed Maine's land surface by approximately 240 meters. This depression enabled marine waters to transgress upon the Seaboard Lowlands once the ice sheet retreated. "Moraines are most numerous in the formerly submerged areas near the coast," and typically trend to the east and northeast. Other glacial/marine deposits dominate the Seaboard Lowlands section in Maine. (Thompson W. , 2015)

[34] 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).
[35] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses.
[36] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000).

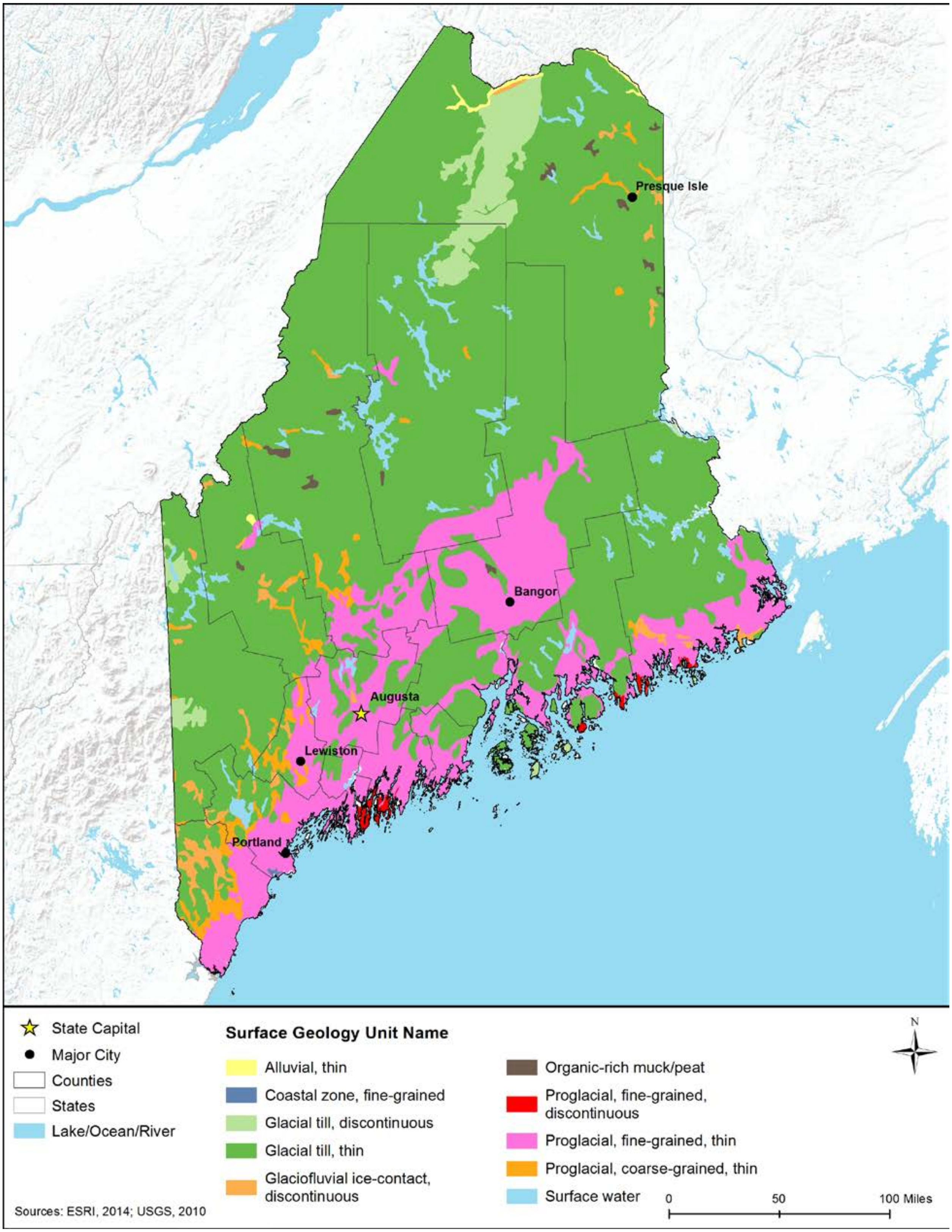


Figure 6.1.3-2: Generalized Surface Geology for Maine

6.1.3.5 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),[37] rock composition, and regional tectonism.[38] 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 (USGS, 2013b).

The bedrock geology of Maine reveals more than 500 million years of geologic history. Precambrian (older than 542 MYA) rocks exist in northwestern Maine (near the Chain Lakes) and Islesboro, ME, on Penobscot Bay; these areas contain the oldest rocks in Maine (1.5 billion years of age). At Chain Lakes, the Precambrian rocks are adjacent to younger rocks, indicating that the Chain Lakes rocks may have originally been part of another land mass that affixed itself to North America. (Maine Geological Survey, 2012)

During the late Cambrian Period (497 to 485 MYA), another landmass converged with the Chain Lakes microplate during the Penobscottian Orogeny.[39] Folding, faulting, and low-grade metamorphism[40] associated with this event are recorded in rocks throughout central Maine. This event was followed up by the Taconic Orogeny approximately 450 MYA, which impacted rocks of northern Maine. Coastal Maine's geology reflects highly metamorphosed volcanic and sedimentary rocks from the Cambrian and Ordovician Periods; fossils in these layers suggest that they were originally parts of oceanic islands that subsequently affixed themselves to the North American continent. The mountains created by the Penobscottian and Taconic Orogenies caused regional uplift, which led to subsequent erosion and deposition of the eroded sediments. (Maine Geological Survey, 2012)

During the early Devonian Period (420 to 394 MYA), North America collided with a very significant land mass to the east in an event known as the Acadian Orogeny. The dominant northeast-southwest trending orientation of rock layers in Maine are attributed to the Acadian orogeny. Sedimentary rocks in southwestern and coastal Maine were metamorphosed to gneiss[41] during the Acadian Orogeny. During the Early Devonian, erosion and sediment deposition occurred in scattered locales, producing the youngest group of stratified rocks in Maine. (Maine Geological Survey, 2012)

In summary, the geologic history recorded in Maine's bedrock spans half a billion years. Several major cycles of mountain building, deformation, igneous activity, erosion, and deposition are responsible for the complex bedrock observed today. Figure 6.1.3-3 displays the generalized bedrock geology for Maine.

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[37] 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).
[38] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust" (USGS, 2015d).
[39] Orogeny: "The process of the formation of mountains" (Carter, J.M.; Driscoll, D.G.; Williamson, J.E.; Lindquist, V.A., 2007).
[40] Metamorphic Rock: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids" (USGS, 2015e).
[41] Gneiss: "A coarse-grained, foliated metamorphic rock that commonly has alternating bands of light and dark-colored minerals" (USGS, 2015e).

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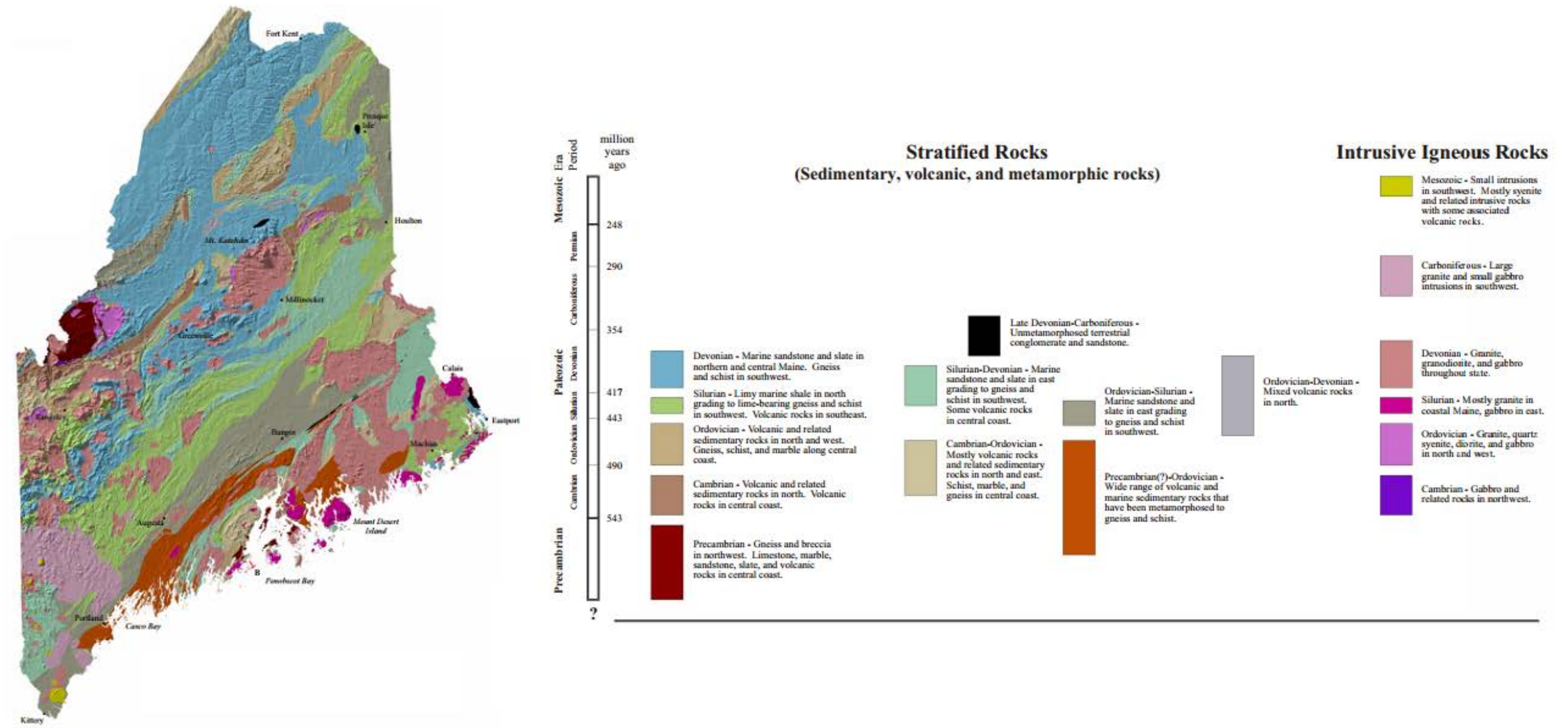

Source: (Maine Geological Survey, 2002)

Figure 6.1.3-3: Generalized Bedrock Geology for Maine

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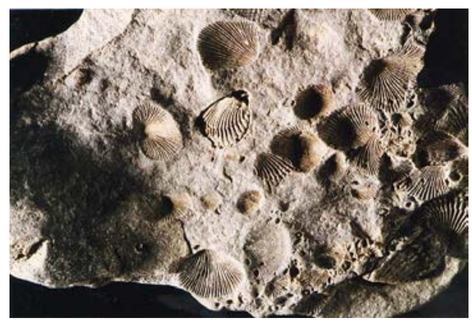
6.1.3.6 *Paleontological Resources*

Fossils in Maine are abundant, with rocks containing the remains of both marine and terrestrial organisms (Maine Geological Survey, 2013). The state fossil of Maine is the Pertica quadrifaria, a Devonian-period primitive plant that lived approximately 390 MYA. The fossil was first discovered in Baxter State Park in 1968, and is only found in three other locations in the world (Maine Geological Survey, 2005a). Fossils in the state are most commonly found in rocks from the Cambrian (542 to 488 MYA), Ordovician (488 to 444 MYA), Silurian (444 to 416 MYA), and Devonian (416 to 359 MYA) Periods, and most are from marine animals (Maine Geological Survey, 2014). However, some terrestrial fossils, including the state fossil, have also been recorded in the Trout Valley Formation, in Baxter State Park (Maine Geological Survey, 2008). The Trout Valley Formation has a maximum exposed thickness of approximately 1,000 feet, and consists mostly of clastic[42] rocks, most of which are a mix of light bluish-gray to black shale, siltstone, sandstone, and conglomerate (USGS, 2015f). During the last Ice Age (in Maine, approximately 35,000 to 15,000 years ago), continental glaciers covered the landscape, removing sediment and rock. When the glaciers retreated, both coastal and inland areas were flooded by the sea and sand and mud covered the sea floor, creating a layer of sediment that preserved marine fossils. Most of these fossils are 11,000 to 12,000 years old. When the ocean receded (approximately 12,500 years ago), large areas of this clay were left above sea level along the coast of Maine (Maine Geological Survey, 2005b) (Maine Geological Survey, 2007a).

Common fossils found in Maine bedrock include brachiopods (the most abundant fossil in the state), corals, crinoids, graptolites, stromatoporoids, snails, and trilobites (Maine Geological Survey, 2008). Fossils of various marine organisms have been found in the more recently formed marine sediments. The most common are invertebrate shells, including barnacles, clams, mussels, scallops, and snails. Buried shells are very well preserved, looking like modern shells even though they can be over 12,000 years old. Fish and mammal remains, including from a mammoth and walrus, have been found in the clay. Fossils from spruce wood, cones, and needles have also been recorded (Maine Geological Survey, 2005b).



Source: (Maine Geological Survey, 2005c)

Brachiopod Fossil

6.1.3.7 *Fossil Fuel and Mineral Resources*

Oil and Gas

Maine does not produce petroleum or natural gas. The state relies on imports of these products from other areas (EIA, 2015c).

[42] Clastic Rocks: "A sedimentary rock composed of fragments (clasts) of pre-existing rock or fossils" (USGS, 2015e).

Minerals

As of 2014, Maine produced $95M in nonfuel mineral resources, ranking 48th in the nation; this accounted for less than 0.12 percent of mineral production value for the United States in 2014. In 2014, Maine's leading nonfuel mineral commodities were sand and gravel (construction), cement (Portland), stone (crushed), stone (dimension), cement (masonry) (USGS, 2016a). Maine is also the third leading producer (out of 13 states) of peat nationwide (USGS, 2015g). In addition to the leading mineral commodities, shale (USGS, 2001), perlite (USGS, 2003b), natural gemstones, dimension stone[43], cement, and common clay are also produced and mined in Maine (USGS, 2015g).

6.1.3.8 Geologic Hazards

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

Earthquakes

There have been three earthquakes in Maine that registered above a magnitude 5.0 on the Richter Scale (Figure 6.1.3-5) (Maine Geological Survey, 2015).[44] Earthquakes are the result of large masses of rock moving against each other along fractures called faults. Earthquakes occur when landmasses on opposite sides of a fault suddenly slip past each other; the grinding motion of each landmass sends out shock waves. The vibrations travel through the Earth and, if they are strong enough, they can damage manmade structures on the surface (USGS, 2012a).

The shaking due to earthquakes can be significant many miles from its point of origin depending on the type of earthquake and the type of rock and soils beneath a given location. Crustal earthquakes, the most common, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale. Subduction zone earthquakes happen where tectonic plates converge. "When these plates collide, one plate slides (subducts) beneath the other, where it is reabsorbed into the mantle of the earth." (Oregon Department of Geology, 2015). Subduction zones are found off the coast of Washington, Oregon, and Alaska (USGS, 2014a). 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). Maine is located far from any convergence boundaries, but is located in the middle of a tectonic plate (Maine DEC, 2003).

[43] Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape (USGS, 2015i).
[44] The Richter scale is a numerical scale for expressing the magnitude of an earthquake on the basis of seismograph oscillations. The more destructive earthquakes typically have magnitudes between about 5.5 and 8.9; the scale is logarithmic and a difference of one represents an approximate thirtyfold difference in magnitude (USGS, 2014f).

Figure 6.1.3-4 depicts the seismic risk throughout Maine. 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 percent g.[45] (USGS, 2010)

No fault in Maine has shown any significant motion in the last 20,000 years; dormant faults that have been inactive for the last 300M years are widespread throughout the state. No recorded earthquake Maine earthquake has resulted in significant damages to property or infrastructure. A map of earthquakes recorded in Maine is included in Figure 6.1.3-5. (Maine Geological Survey, 2015)

Landslides

In Maine, most landslides occur in areas underlain by clay, particularly along coastal and riverine bluffs (Maine Sea Grant, 2015a). "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, 2003c). 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, 2003c).

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, 2003c)

Landslides in Maine have the capacity to result in significant property damage. A 1996 landslide in Rockland was responsible for the destruction of two residences. This landslide moved approximately 400 feet and altered 3.5 acres of terrain (Maine Geological Survey, 2015). More recently, the Federal Emergency Management Agency (FEMA) funded $2.5M in public assistance in response to a series of severe storms, flooding, and landslides in Franklin, Hancock, Knox, Lincoln, Oxford, Piscataquis, Somerset, Waldo, and Washington Counties (FEMA, 2009).

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

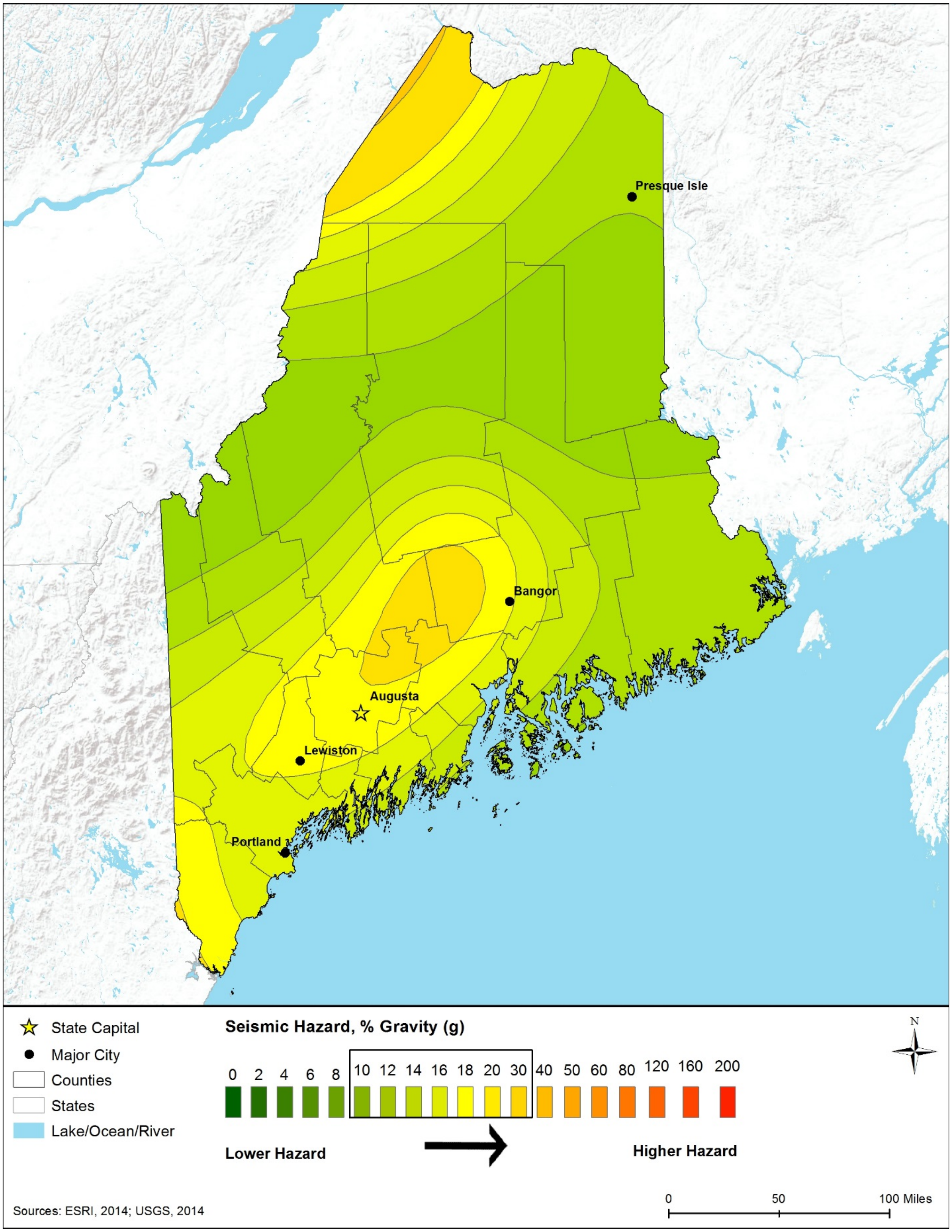


Figure 6.1.3-4: Maine 2014 Seismic Hazard Map

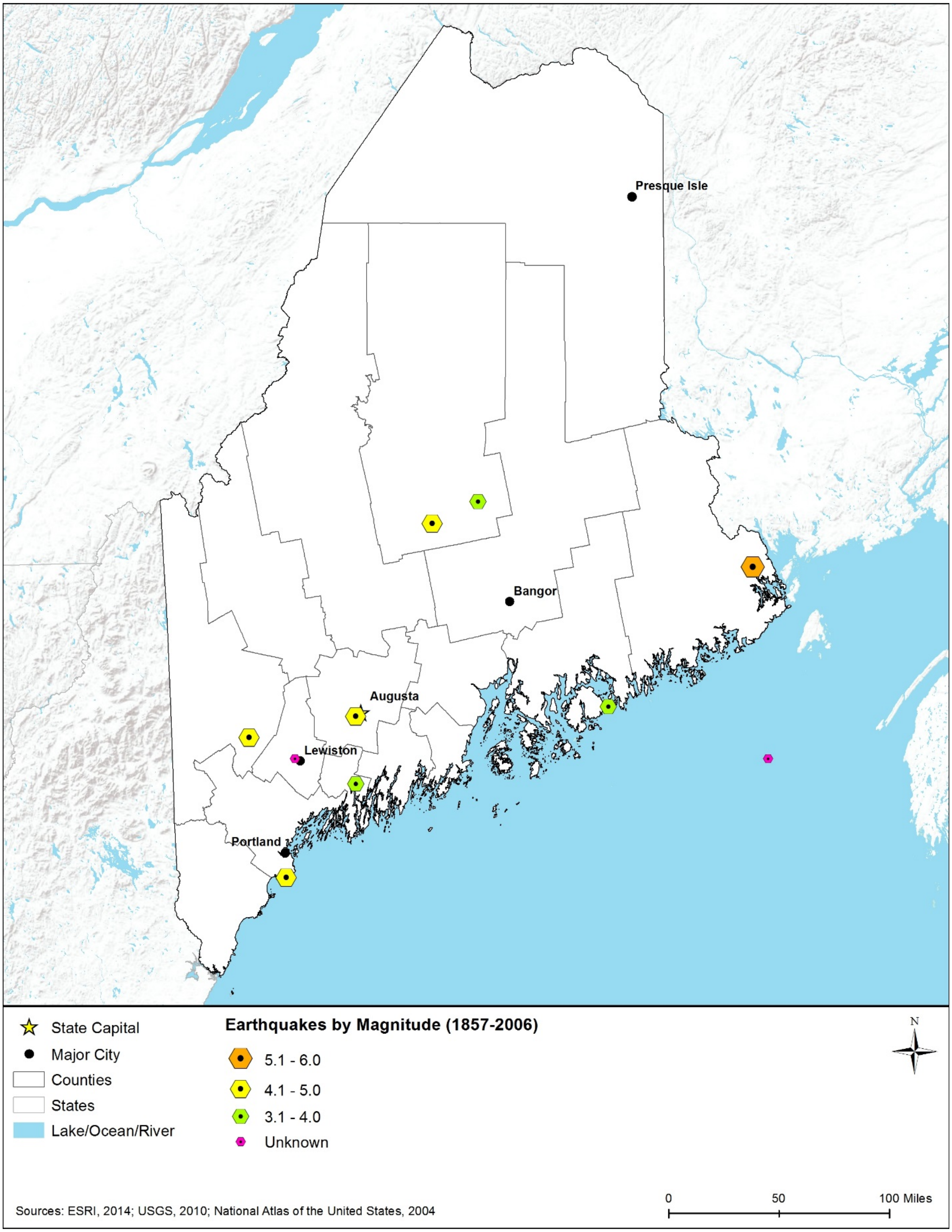


Figure 6.1.3-5: Map of Earthquakes Recorded in Maine

Approximately 46 percent of Maine's coastline can be characterized as bluffs that are composed of unconsolidated sediment (Maine Sea Grant, 2015a). Bluff erosion or removal of vegetation may increase the risk of a landslide. Maine is particularly vulnerable to landslides along coastal bluffs due to increased erosion attributable to sea level rise (Maine Geological Survey, 2015). Figure 6.1.3-6 highlights the areas of Maine that are most susceptible to the occurrence of landslides.

Aerial Image of the 1996 Rockland Landslide

Source: (Maine Geological Survey, 2015)

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, 2013c). 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, 2013c)

In Maine, regional subsidence contributes to higher than expected relative sea level rise along the coast. Whereas global rates of sea level rise persist at approximately 1.7 mm/year, sea level rise rates in the area of Portland, ME, have been measured at 1.91 +/- 0.09 mm/year, with the additional rise attributed to land subsidence in the area (USEPA, 2014a). "Maine's coast is currently experiencing significant local submergence (decreased land elevation) due to lingering effects possibly caused by loading and unloading of receding ice sheets. The rate of sea-level rise is supposed to be greatest in the Eastport area because of more rapid land subsidence in that area, but this conclusion remains controversial" (USEPA, 1995a).

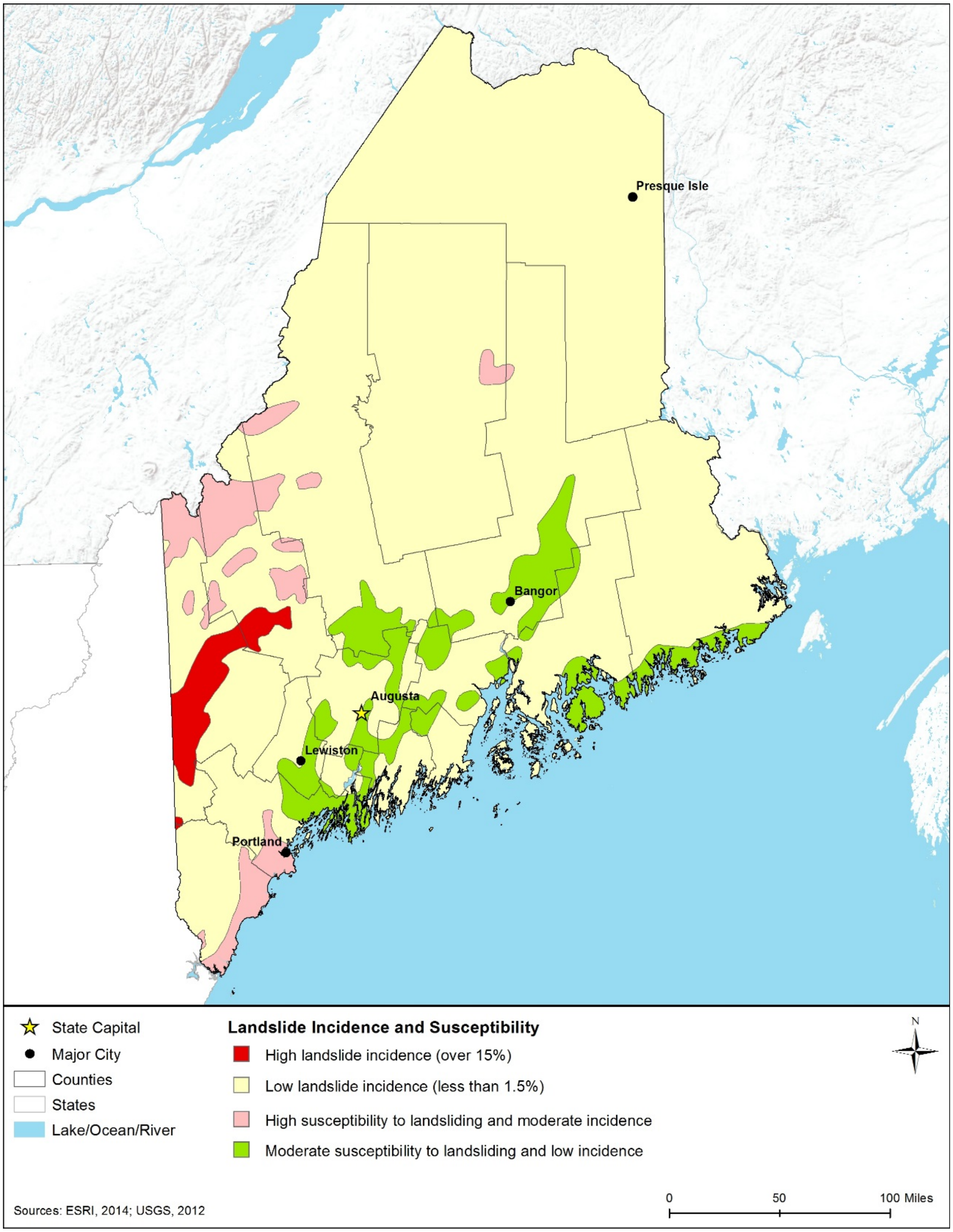


Figure 6.1.3-6: Maine Landslide Incidence and Susceptibility Hazard Map[46]

[46] Susceptibility hazards not indicated in Figure 3.4.8-2 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).

6.1.4 Water Resources

6.1.4.1 Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine[47] waters, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 6.1.5). 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 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, 2014b).

This section provides a summary of surface water and groundwater resources that occur in Maine, including floodplains. This section also considers the differences between freshwater and estuarine/coastal waters. Maine wetland resources are presented in Section 0.

6.1.4.2 Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C. Table 6.1.4-1 summarizes the major Maine laws and permitting requirements relevant to the state's water resources.

Table 6.1.4-1: Relevant Maine Water Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Land Use Planning Commission Rules	Maine Department of Agriculture, Conservation, and Forestry	Regulates rules related to construction of structures adjacent to lakes, development that could impact surface or groundwater quality, and construction projects in floodplains.
Natural Resource Protection Act (NRPA)	Maine DEP	Regulates any activity located in, over, or adjacent to a great pond, river, stream, or brook, including the discharge of dredged or fill materials.
Clean Water Act (CWA) Section 404 permit, Maine State General Permit	U.S. Army Corps of Engineers, New England District	Oversees projects within the St. Johns and St. Croix River basins, requiring them to meet special conditions for approval to avoid impacts to international boundary waters
Maine Water Quality Standards (33 U.S.C. 1341)	Maine DEP	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from Maine DEP indicating that the proposed activity will not violate water quality standards.

[47] 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, 2015n).

State Law/Regulation	Regulatory Agency	Applicability
Maine Pollution Discharge Elimination System (MPDES)	Maine DEP	Regulates any activity that results in a discharge to waters of the state. Some exemptions exist including discharge of dredged or fill materials (covered by NRPA Permit).

Sources: (Maine Land Use Planning Commission, 2007)(Maine DEP, 2015f) (USACE, 2014) (Maine DEP, 2015g) (Maine DEP, 2011a) (Maine DEP, 2002)

6.1.4.3 Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams, as well as estuarine and coastal waters. According to the Maine DEP, Maine has over 7,700 miles of rivers, more than 30,000 miles of streams, approximately 32,000 lakes, ponds, and reservoirs; and approximately 2,700 miles of coastline (Maine DEP, 2012a). These surface waters supply drinking water; provide aquatic habitat; and support recreation, tourism, agriculture, fishing, power generation, and industry across the state (Maine DEP, 2012a).

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains all the streams and rainfall to a common outlet (e.g., reservoir, bay). Maine's waters (lakes, rivers, and streams) are divided into 21 major watersheds, or drainage basins (Figure 6.1.4-1) (Maine DEP, 2012b). Visit www.maine.gov/dep/water/monitoring/305b/ for information and additional maps about Maine DEP's watersheds, which can be found in the appendices of the 2012 Integrated Water Quality Monitoring and Assessment Report.

The Maine Coastal watershed lies along the state's norther Atlantic coast and drains to a series of estuaries including Penobscot Bay, Frenchman Bay, and Blue Hill Bay. In central Maine, the Penobscot River basin is divided into the Lower Penobscot, East Branch Penobscot, and West Branch Penobscot watersheds which drain from Mt. Katahdin in the north to Penobscot Bay. The Presumpscot watershed drains to the Presumpscot River in the southwestern portion of the state which in turn drains to Casco Bay. (Maine DEP, 2012b)

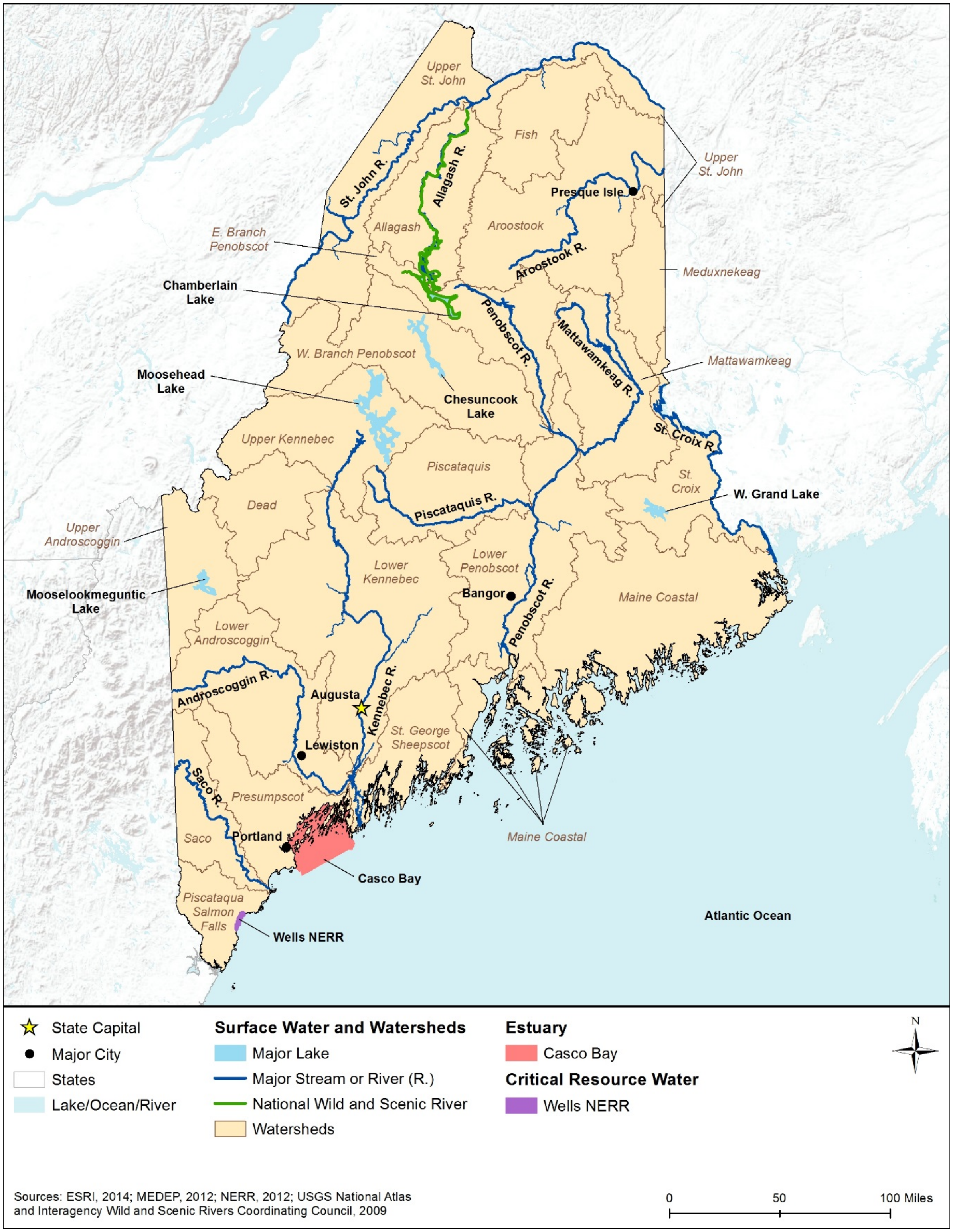


Figure 6.1.4-1: Major Maine Watersheds, Defined by Maine DEP, Surface Waterbodies, Major Estuary, and Critical Resource Waters

Freshwater

As shown in Figure 6.1.4-1, there are 10 major rivers in Maine: Saco, Androscoggin, Kennebec, Penobscot, Piscataquis, St. Croix, Matta-wamkeag, Aroostook, Allagash, and St. John. The St. John River is located in the northern part of the state. A portion of the St. John River's approximately 420 total miles forms part of Maine's northern border with Canada (Maine DEP, 2007a). The Penobscot River, at approximately 100 miles in length, flows south through the central part of the state into Penobscot Bay on the Atlantic coast. The St. Croix River forms part of Maine's eastern border with Canada before it flows into the Atlantic Ocean (Maine DEP, 2007a). Maine also contains over 1,600 square miles of lakes, ponds, and reservoirs, including approximately 35 reservoirs used for water supply (Maine DEP, 2007a) (Maine DEP, 2012a). The state has approximately 520 dams that are used for flood control, hydroelectric power generation, and as drinking water sources (Maine DEP, 2007a).

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 Maine, from ocean waves and storms. Maine'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)

Maine's coastal water environments exist along the state's Atlantic coast which stretches approximately 2,750 miles from the New Hampshire border in the south to the Canadian border in the north (Maine DEP, 2012a). The Maine DEP, National Oceanic and Atmospheric Administration (NOAA), and other government agencies and municipalities implement coastal programs in Maine such as Coastal Community Planning, and the Maine Coastal Mapping Initiative (Maine DEP, 2015h). For more information on Maine's Coastal Programs, visit http://www.maine.gov/dacf/mcp.

Maine has one major estuary located on the state's southern Atlantic coast (Figure 6.1.4-1):

- The **Casco Bay Estuary** has an area of approximately 230 square miles and contains more than 750 islands, islets, and exposed ledges at mean high tide. The bay's watershed of approximately 990 square miles is one of the most densely populated in Maine, and is home to Portland, the largest city in the state (Casco Bay Estuary Project, 1996) (U.S. Census Bureau, 2012b). The USEPA designated Casco Bay as an Estuary of National Significance in 1990, and the associated Comprehensive Conservation and Management Plan (CCMP) was finalized in 1996 and later updated in 2006. The CCMP sets forth five management action items: stormwater; shellfish and swimming areas; habitat conservations; toxic pollution; and stewardship. For more information on Casco Bay, visit USEPA's National Estuary Program website at http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2.

Maine also has many small and medium sized estuaries including Penobscot Bay, Blue Hill Bay, and Frenchman Bay. Penobscot Bay is located on Maine's central Atlantic coast at the mouth of the Penobscot River and is approximately 45 miles wide and 37 miles long (Maine Sea Grant, 2015b). Blue Hill Bay and Frenchman Bay are located just north of Penobscot Bay and are separated by Mt. Desert Island north of Frenchman Bay, the Maine coastline features a series of smaller bays (such as Gouldsboro Bay, Dyer Bay, Pigeon Hill Bay, Narragaugus Bay, Wohoa Bay, Chandler Bay, Englishman Bay, Machias Bay, and Cobscook Bay along the Canadian border in the north).

The Wells National Estuarine Research Reserve, administered by NOAA, is part of a network of 28 National Estuarine Research Reserves (NERRs) across the country whose mission is to "practice and promote stewardship of coasts and estuaries through innovative research, education, and training using a place-based system of protected areas" (NERRS, 2011). The Wells NERR is located on the southern coast of Maine and is comprised of approximately 2,300 acres which includes dunes, beaches, salt marshes, riparian areas, and upland forests and fields. The reserve features several species of seagrass, more than 50 species of fish, more than 250 species of birds, and over 30 species of mammals. (NOAA, 2015a)

6.1.4.4 Sensitive or Protected Waterbodies

Wild and Scenic Rivers

The Allagash Wilderness Waterway is the only designated National Wild and Scenic River in Maine (Figure 6.1.4-1) (National Wild and Scenic Rivers System, 2015a). The designated segments of the Allagash River run from the Telos Lake Dam, north to Allagash Lake, and from Chamberlain Lake, north to the confluence with Twin Brook (National Wild and Scenic Rivers System, 2015b). The Allagash Wilderness Waterway includes eight lakes and four ponds and flows through hardwood forest and through conifer swamps (Maine DACF, 2012) (National Wild and Scenic Rivers System, 2015b). The Allagash Wilderness Waterway is the first Wild and Scenic River to be administered by a state, and it is surrounded by a privately owned forest that is used for commercial purposes (Maine DACF, 2012). Wildlife within the river's watershed includes bobcat, lynx, and bird species such as the common loon, great blue heron, and great horned owl. (Maine DACF, 2012)

6.1.4.5 Impaired Waterbodies

Water quality is evaluated based on several constituents and attributes, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, pesticides, water color, condition of stream banks and lake shores; observations of communities of aquatic wildlife; and sampling of fish tissue or sediment. Under Section 303(d) of the CWA, states are required to report a listing of impaired waters[48], the causes of impairment, and probable sources. The following summarizes the water quality of Maine's major waterbodies that have been assessed by category, percent impaired, designated use[49], cause, and probable sources in Table 6.1.4-2. Figure 6.1.4-2 shows the Section 303(d) waters in Maine as of 2012.

[48] 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, 2015n).

[49] 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, 2015n).

Table 6.1.4-2: Section 303(d) Impaired Waters of Maine, 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	68%	4%	Drinking water supply after treatment, fish and other aquatic life, fish consumption, fishing, navigation, primary contact recreation, secondary contact recreation.	Dissolved oxygen, polychlorinated biphenyls, dioxin	Non-point source, agriculture, industrial point source discharge
Lakes, Reservoirs, and Ponds	100%	9%	Fish and other aquatic life, primary contact recreation	Impaired biota, turbidity, nutrients	Impacts from flow modification, stormwater, wildlife
Estuaries and Bays	95%	100%	Fish and other marine life, propagation and harvesting of shellfish	Fecal coliform, aquatic life, toxics	Municipal point source, non-point source, stormwater

[a] Some waters may be considered for more than one water type
[b] Please note that Maine did not assess all waterbodies within the state.

Source: (USEPA, 2015a)

Waterbodies throughout the state are affected by various water quality impacts. For example Belfast Bay is impaired by pathogens[50], Graham Lake is impaired by turbidity[51], and parts of the Kennebec River are impaired by polychlorinated biphenyl (PCBs) (USEPA, 2015b). All of Maine's assessed estuaries and bays are impaired (USEPA, 2015a). Designated uses of the impaired estuaries and bays include fish and other estuarine and marine life, and propagation and harvesting of shellfish (USEPA, 2015a).

According to Maine DEP's 2012 Integrated Water Quality Monitoring and Assessment Report, approximately 14 percent of Maine's river and stream miles support all designated uses, and over 80 percent of river and stream miles support at least one designated use. Approximately half of all of the state's lakes and ponds support all designated uses, while the other half support at least one designated use (USEPA, 2015a). For more information on Maine's water quality, visit www.maine.gov/dep/water/monitoring/305b.

[50] Pathogen: a bacterium, virus, or other microorganism that can cause disease (USEPA, 2015n).
[51] Turbidity: the cloudiness or lack of clarity of water (USEPA, 2015n).

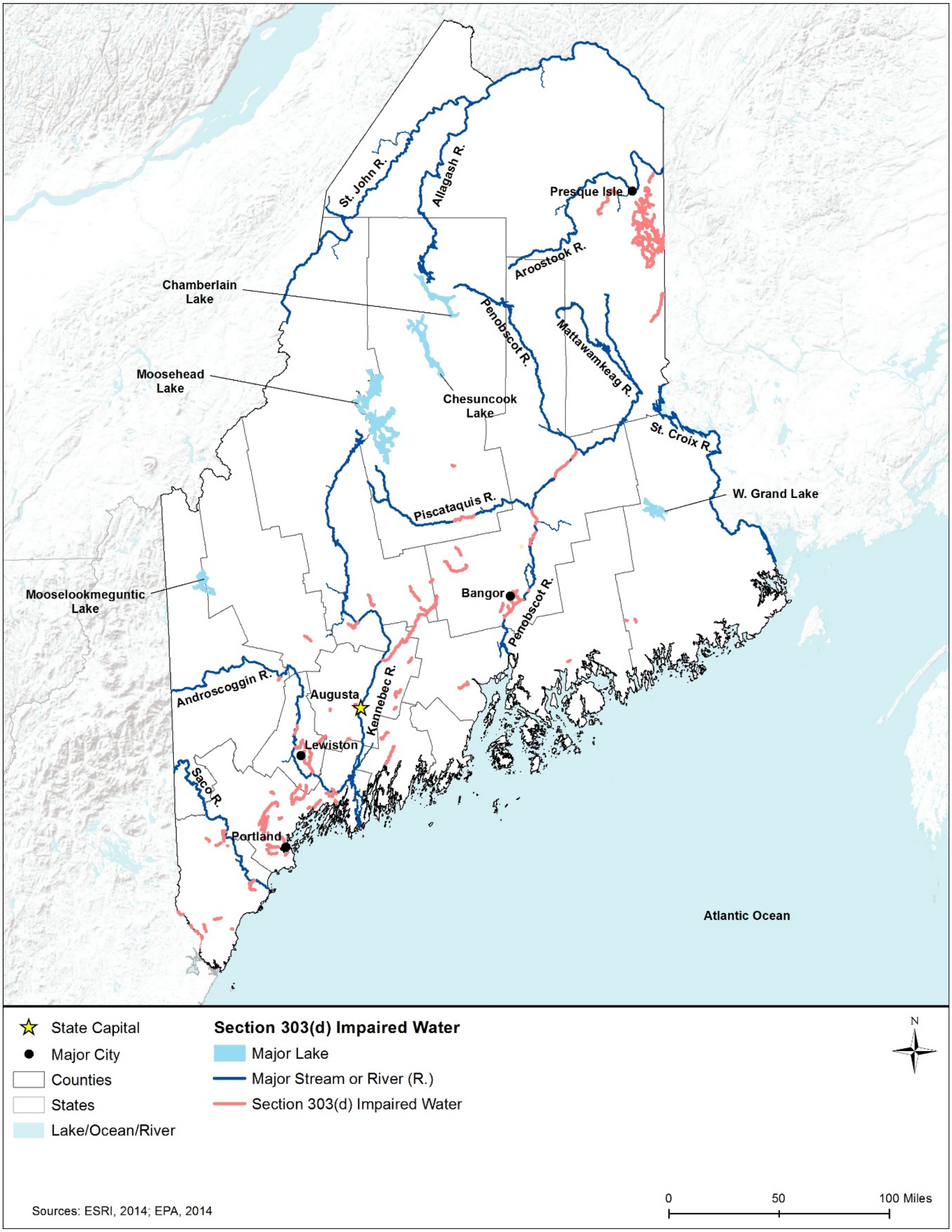


Figure 6.1.4-2: Section 303(d) Impaired Waters of Maine, 2010

Leading causes of river and stream impairment are oxygen depletion, nutrients, PCBs, dioxins, and pesticides. Leading causes of lake impairments are methylmercury, total phosphorous, and turbidity. All of Maine's estuarine and coastal waters fully support water quality standards for swimming, however fish consumption advisories exist for the saltwater species striped bass and bluefish. (Maine DEP, 2012a)

6.1.4.6 Floodplains

Floodplains are lowlands along inland or coastal waters, including flood-prone areas of offshore islands. The 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 provides shade, which helps to regulate water temperature for aquatic species. During flood events, sediment and debris settle out and collect on the floodplain, enriching the soil with additional nutrients. Pollutants from floodwater runoff are also filtered by floodplain vegetation and soils; thereby improving water quality. Furthermore, floodplains protect natural and built infrastructure by providing floodwater storage, erosion control, water quality maintenance, and groundwater recharge. Historically, floodplains have been favorable locations for agriculture, aquaculture, and forest production due to the relatively flat topography and nearby water supply. Floodplains can also offer recreational activities, such as boating, swimming, and fishing, as well as hiking and camping. (FEMA, 2014a)

Floodplains in Maine include the following:

- **Riverine floodplains:** These occur along rivers and streams where overbank flooding may occur, inundating adjacent land areas. In steep river valleys found in 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. In contrast, 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. (NOAA, 2015b). Maine is highly susceptible to flood events due to the state's location in the northeastern corner of the county. This area is frequently impacted by weather systems as they make their way north along the eastern Atlantic coast. Flooding in Maine is generally caused by heavy rainfall and can be intensified by a number of seasonal factors including snowmelt in the spring and heavy thunderstorms in the summer (Maloney & Barlett, 2013). In the winter frozen ground can prevent rainfall from being absorbed into the ground, and ice in rivers can lead to the formation of ice jams, which also contribute to flooding (Maloney & Barlett, 2013).

Source: *(NOAA, 2015c)*

Figure 6.1.4-3: Flooding along Route 201 in Farmingdale, ME

Since 1970, Maine has had 33 major disaster declarations that resulted in severe flooding; five of which have occurred since 2010 (FEMA, 2015a). The most catastrophic flood event occurred on April 1, 1987 resulting from a combination of several factors, including frozen ground, melting snow, and rainfall of over 8 inches (Figure 6.1.4-3). Widespread flooding caused over $100M worth of damage and impacted almost the entire state with 14 out of the 16 counties declared as a disaster area (as cited in the 1987 State of Maine Hazard Mitigation Plan). (Maloney & Barlett, 2013)

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. As of May 2015, Maine had 985 communities participating in the National Flood Insurance Program (NFIP) (FEMA, 2015b). The NFIP was established to reduce the economic and social cost of flood damage by subsidizing insurance payments. 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, 2015c). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities in exchange for doing more than the minimum NFIP requirements for floodplain management. As of June 2014, Maine had 22 communities participating in the CRS (FEMA, 2014c).[52]

[52] 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/1398878892102-5cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

6.1.4.7 Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and includes underground water that occupies pore spaces between sand, clay, or rock particles. An aquifer is a permeable geological formation that stores or transmits water, such as 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.

Maine's principal aquifers are the New York and New England carbonate rock aquifer[53] and aquifers of alluvial and glacial origin.[54] Maine's New York and New England carbonate rock aquifer is located in the northeastern part of the state and consists of limestone and other sedimentary rock (USGS, 2014c). Maine's aquifers of alluvial and glacial origin can be found throughout the state. Approximately 20 billion gallons of groundwater are used annually in Maine (Maine Geological Survey, 2007b). Generally, the water quality of Maine's principal aquifers is suitable for drinking and most uses (USGS, 1995). Threats to Maine's groundwater quality include leaking septic systems, spilled hazardous materials, agriculture, and leaking storage facilities (Maine DEP, 2012a). Table 6.1.4-3 provides details on aquifer characteristics in the state; Figure 6.1.4-4 shows Maine's principal and sole source aquifers.

Table 6.1.4-3: Description of Maine's Principal Aquifers

Aquifer Type and Name	Location	Groundwater Quality
New York and New England Carbonate-rock - Consolidated bedrock of limestone, dolomite, and marble and are generally soluble	Occurs in the northeastern portion of the state	Water is suitable for most uses, including drinking. Dissolved solids range from 220 to 700 milligrams per Liter (mg/L). The water is slightly basic and very hard.
Aquifers of Alluvial and Glacial Origin - Layered deposits of sand, gravel, silt, and clay eroded by glaciers	Occurs in patches throughout the state	Water is generally suitable for most uses and ranges from acidic to slightly basic. The water is soft, and in some areas iron and manganese concentrations are high enough to require treatment. Some areas have increased levels of chlorides, nitrates, and other dissolved solids as a result of contamination.

Sources: (USGS, 1995) (Maine Geological Survey, 1987a) (Maine Geological Survey, 1987b) (Maine Geological Survey, 1988)

Sole Source Aquifers

The USEPA defines a sole source aquifer (SSA) as one that "supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" (USEPA, 2014b). Section 1424(e) of the Safe Drinking Water Act authorizes the SSA Protection Program (see Appendix C for more information on the SSA and specific regulatory considerations). Maine has four designated SSAs (as shown in Figure 6.1.4-4), all of which occur on islands off the state's Atlantic coast (USEPA, 2014c).

[53] Carbonate-rock aquifers: consist of limestone with highly variable water-yielding properties (some yield almost no water and others are highly productive aquifers) (Olcott, 1995).
[54] Aquifers of alluvial (sand, silt, or gravel materials left by river waters) and glacial origin: highly productive aquifers in the northern part of the country, consisting of mostly sand and gravel deposits formed by melting glaciers (USGS, 2016b).

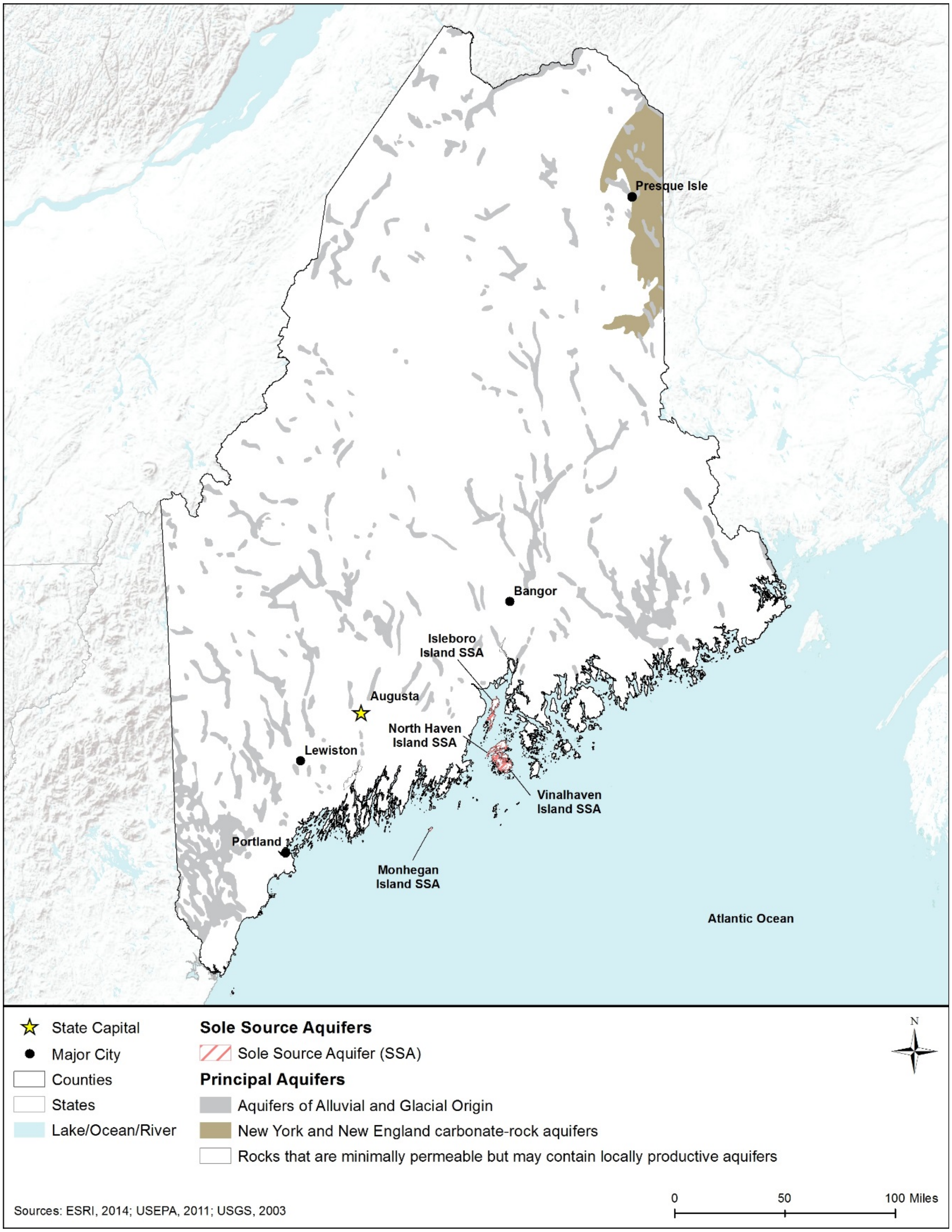


Figure 6.1.4-4: Principal and Sole Source Aquifers of Maine

6.1.5 Wetlands

6.1.5.1 Definition of the Resource

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

The USEPA estimates that "more than one-third of the United States' threatened and endangered species live only in wetlands, and nearly half of such species use wetlands at some point in their lives" (USEPA, 1995b). 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.

6.1.5.2 Specific Regulatory Considerations

Table 6.1.5-1 summarizes the major Maine state laws and permitting requirements relevant to the state's wetlands.

Table 6.1.5-1: Relevant Maine Wetlands Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Mandatory Shoreland Zoning Act (MSZA)	Maine DEP	Requires municipalities to adopt zoning and land use control ordinances to protect shoreland areas.[55]
Natural Resources Protection Act (NRPA)	Maine DEP	Permit is required when an "activity" will be in, on, or over any protected natural resource,[56] or adjacent to (within 75 feet of) (A) a coastal wetland, great pond, river, stream, or brook or significant wildlife habitat contained within a freshwater wetland, or (B) certain freshwater wetlands.[57] An "activity" is (A) dredging, bulldozing, removing or displacing soil, sand, vegetation or other materials; (B) draining or otherwise dewatering; (C) filling, including adding sand or other material to a sand dune; or (D) any construction, repair or alteration of any permanent structure.

[55] Zoning ordinances outline what types of activities can occur in applicable areas. Shoreland areas lie within 75 feet of the high-water line of a stream or within 250 feet of the normal high-water line of any great pond, river or saltwater body; the upland edge of a coastal wetland; or the upland edge of a freshwater wetland, except as otherwise provided.

[56] Under the NRPA, "protected natural resources" are coastal sand dune systems, coastal wetlands, significant wildlife habitat, fragile mountain areas, freshwater wetlands, great ponds and rivers, streams or brooks (Maine State Legislature, 2015).

[57] Freshwater wetlands include, for purposes of the MSZA, freshwater swamps, marshes, bogs and similar areas, other than forested wetlands, which are: (a) of ten or more contiguous acres, or of less than ten contiguous acres and adjacent to a surface waterbody, excluding any river, stream or brook, such that, in a natural state, the combined surface area is in excess of ten acres; and (b) inundated or saturated by surface or groundwater at a frequency and for a duration sufficient to support, and which under normal circumstances do support, a prevalence of wetland vegetation typically adapted for life in saturated soils. Freshwater wetlands may contain small stream channels or inclusions of land that do not conform to the criteria of this subsection.

State Law/Regulation	Regulatory Agency	Applicability
NRPA	Maine DEP	Regulates activities taking place in or adjacent to wetlands and waterbodies that should not significantly affect the environment if carried out according to the standards contained in the regulations.
NRPA	Maine DEP	Issues water quality certifications are issued as part of the NRPA permit.
NRPA	Maine DEP	Regulates vernal pools meeting both physical and biological criteria.[58] An activity in, on, or over significant vernal pools must avoid unreasonable impacts on the significant vernal pool habitat and obtain approval from the Maine DEP, through a Permit by Rule or individual NRPA approval. In order for a vernal pool to be classified as significant, some obligate species (wood frogs, blue spotted salamanders, spotted salamanders, or fairy shrimp) must not only be present (represented by number of egg masses counted during amphibian breeding season), but must be present in certain numbers, as defined in the NRPA, Chapter 335(9)[59]
Maine Land Use Regulation Commission (LURC) statute, "Use Regulation," replaces the MSZA and NRPA in areas of LURC jurisdiction	Maine Land Use Planning Commission	Land use standards include development standards for wetland alterations and guidelines for timber harvesting near rivers, streams, ponds, wetlands, and tidal waters.[60]
Wastewater Discharge Law	Maine DEP	Requires a license for pollutants discharging to a stream, river, wetland, or lake in Maine, or to the ocean (i.e., sanitary wastewater, industrial or commercial process water)

[58] The NRPA defines a vernal pool as, "A vernal pool, also referred to as a seasonal forest pool, is a natural, temporary to semipermanent body of water occurring in a shallow depression that typically fills during the spring or fall and may dry during the summer. Vernal pools have no permanent inlet and no viable populations of predatory fish. A vernal pool may provide the primary breeding habitat for wood frogs *(Rana sylvatica)*, spotted salamander *(Ambystoma maculatum)*, blue-spotted salamanders *(Ambystoma laterale)*, and fairy shrimp *(Eubranchipus sp.)*, as well as valuable habitat for other plants and wildlife including several rare, threatened, and endangered species. A vernal pool intentionally created for the purposes of compensatory mitigation is included in this definition."

[59] Presence of fairy shrimp in any life stage; 10 or more blue spotted salamander egg masses; 20 or more spotted salamander egg masses; 40 or more wood frog egg masses; and the presence of a state-listed species that commonly requires a vernal pool for a critical portion of its life-history, including: Blanding's turtle (*Emydoidea blandingii*), spotted turtle (*Clemmys guttata*), or ringed boghaunter dragonfly (*Williamsonia lintneri*); or, presence of any of the following rare species: ribbon snake (*Thamnophis sauritus*), wood turtle (*Clemmys insculpta*), swamp darner dragonfly (Epiaeschna heros), or comet darner dragonfly (*Anax longipes*).

[60] Wetland protection subdistricts are regulated in three categories: (a) P-WL1 – wetlands of special significance, (b) P-WL2 – scrub-shrub and other nonforested freshwater wetlands, excluding those under P-WL1; and (c) P-WL3 – forested freshwater wetlands, excluding those under P-WL1 and P-WL2. LURC regulates freshwater and coastal wetlands identified by the National Wetlands Inventory. If a proposed activity would impact more than 15,000 square feet of wetlands, the applicant must delineate wetlands on the property, using the USACE 1987 Wetlands Delineation Manual.

State Law/Regulation	Regulatory Agency	Applicability
Section 404 of the Clean Water Act (CWA) Maine State Program General Permit (SPGP)	U.S. Army Corps of Engineers (USACE), New England District	USACE general permit categorizes projects with less than 15,000 square feet of wetland impact as Category 1, non-reporting (i.e., the project proponent can proceed without notifying the USACE, provided he or she obtains any necessary authorizations from the state). Category 2 projects are those projects that would cause between 15,000 square feet and 3 acres of impact (including secondary impacts) to inland waterways or wetlands; these require an application to the USACE, which can be filed concurrently with the Maine state permit application. Projects with over three acres of wetland impacts are required to file an application for an individual permit directly with the USACE.

Sources: (Maine DEP, 2015i) (Maine DEP, 2008) (Maine DEP, 2015j) (Maine Land Use Planning Commission, 2015) (Maine DEP, 2013a)

6.1.5.3 Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service's (USFWS)'s National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined in (Cowardin, Carter, Golet, & LaRoe, 1979). The Wetlands Classification Standard includes five major wetland systems, as detailed in

Table 6.1.5-2. The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats. (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)

Table 6.1.5-2 uses 2014 NWI data to characterize and map Maine wetlands on a broad-scale. The data is not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known. The map codes and colorings in Table 6.1.5-2 correspond to the wetland types in Figure 6.1.5-1.

Table 6.1.5-2: Maine 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	1,741,807
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[61], prairie potholes, and sloughs.	Throughout the state	205,422
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	56,105
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Other Palustrine wetland	Misc. Types	Farmed wetland, saline seep[62], and other miscellaneous wetlands are included in this group.	Throughout the state	685
Riverine wetland	R	Riverine systems include rivers, creeks, and streams. They are contained in natural or artificial channels periodically or continuously containing flowing water.	Throughout the state	4,778
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	18,571

[61] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water (Edinger, et al., 2014).
[62] Saline seep is an area where saline groundwater discharges at the soil surface. Saline soils and salt tolerant plants characterize these wetland types (City of Lincoln, 2015).

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (Acres)[b]
Estuarine and Marine intertidal wetland	E2/M2	Intertidal wetlands include the areas between the highest and lowest tide level. Semidiurnal tides (two high 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 coasts	39,088

[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin, et.al, 1979, some data has been revised based on the latest scientific advances. The USFWS uses these standards as the minimum guidelines for wetlands mapping efforts. (FGDC, 2013)
[b] All acreages are rounded to the nearest whole number. The maps are prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. (USFWS, 2015b)
Sources: (Cowardin, Carter, Golet, & LaRoe, 1979) (USFWS, 2015a) (FGDC, 2013)

In Maine, based on 2014 NWI data, wetlands cover approximately 10 percent of the state's land area. Over 97 percent are palustrine wetlands (wooded swamps, shrub swamps, bogs, freshwater meadows, freshwater marshes) across the state, approximately 2 percent are estuarine and intertidal marine types (tidal flats, salt marsh, brackish marsh, and reefs) along the coast, and riverine and lacustrine wetlands comprise approximately one percent, scattered throughout the state, as shown in Figure 6.1.5-1. (Maine DEP, 1996) (USFWS, 2014a)

Palustrine Wetlands

In Maine, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, swamps, bogs, and ponds). Common tree types found in palustrine forested wetlands (PFO) in Maine are American elm (*Ulmus americana*), silver maple (*Acer saccharinum*), and green ash (*Fraxinus pennsylvanica*), with ferns, false nettle (*Boehmeria cylindrical*), and jewelweed (*Impatiens capensis*). Palustrine scrub-shrub wetlands (PSS) in Maine consist of dominant tree species such as alders (*Alnus* spp.), red osier dogwood (*Cornus sericea*), mountain holly (*Ilex mucronata*), buttonbush (*Cephalanthus occidentalis*), and meadowsweet (*Filipendula ulmaria*) with ferns (monilophytes) and skunk cabbage (*Symplocarpus foetidus*). PFO and PSS are the most common type of palustrine wetlands within Maine. Palustrine emergent wetlands (PEM), or freshwater marsh, fen (defined below), and slough[63], in the geographic location of Maine support diverse plant and animal populations. Common PEM marsh plants in Maine include grasses, rushes, and cattails. (Maine DEP, 1991)

Maine has greatest diversity of peatland type wetlands than anywhere in the United States, due to a mix of its geographic (latitude and longitude), elevation, and climate. Generally, peatland wetlands include bogs and fens. Bogs are acidic wetlands that form thick organic (peat) deposits up to 50 feet deep or more. They have little groundwater influence and are recharged through precipitation. The stagnant, nutrient-poor, acidic water slows all processes in a bog, including nutrient recycling, making bogs very sensitive to external disturbance. (Edinger, et al., 2014)

[63] Slough: "swamp or shallow lake system, usually a backwater to a larger body of water" (USEPA, 2015m).

Rare bogs found in Maine include maritime slope bogs, coastal plateau bogs, and eccentric bogs (MDIFW, 2005).

Fens, unlike bogs, are nutrient-rich, grass- and sedge[64]-dominated emergent wetlands that are recharged from groundwater and have continuous running water. This wet meadow habitat supports distinctive plant communities, including many state endemic species

[64] Sedge: an herbaceous plant with triangular cross-sectional stems and spirally arranged leaves (grasses have alternative leaves) typically associated with wetlands or poor soils.

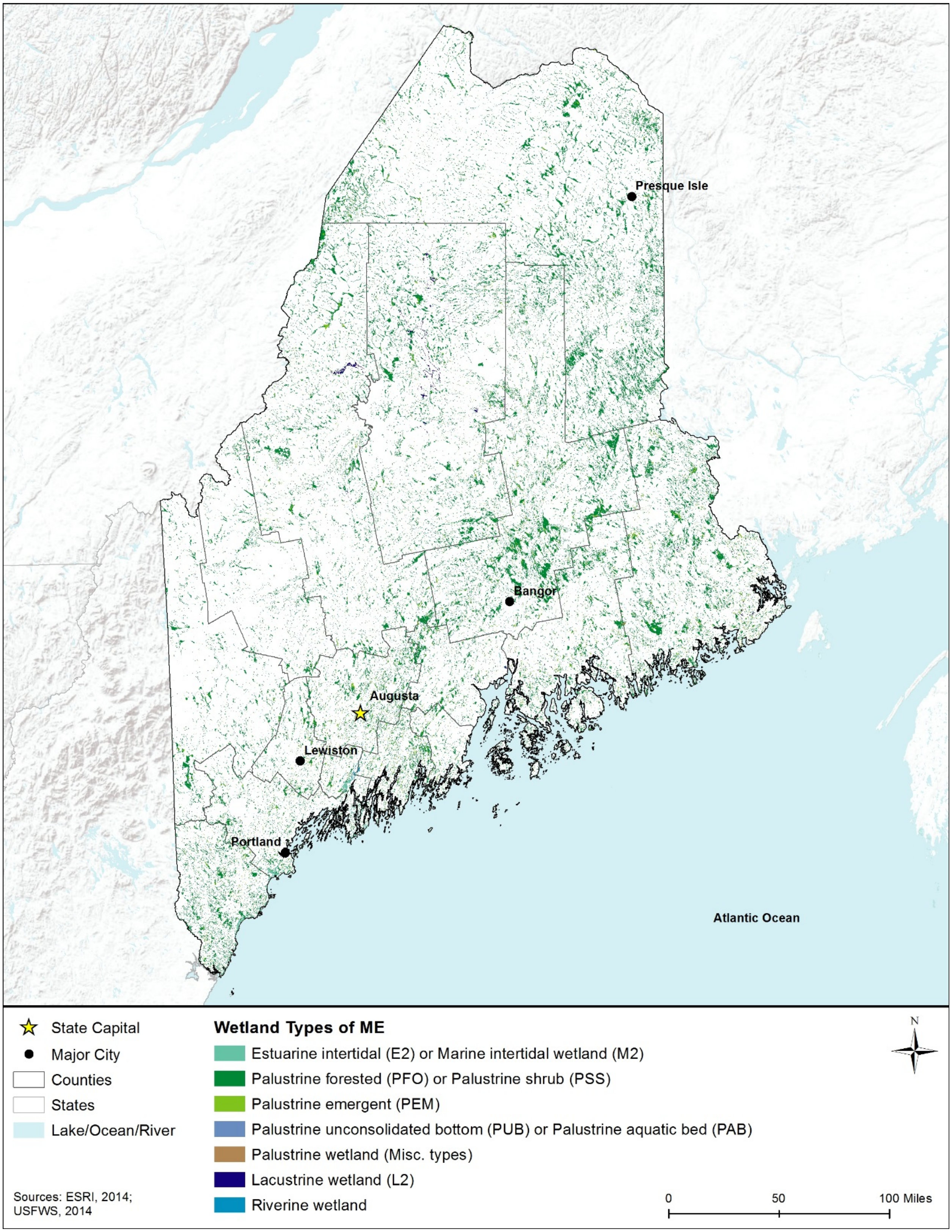


Figure 6.1.5-1: Wetlands by Type, in Maine, 2014

(Edinger, et al., 2014). Rare fens found in Maine include circumneutral fens[65] (habitat for dwarf shrubs, including *Shrubby cinquefoil*) and patterned fens.[66] Great Heath, on Mt. Desert Isle, is one example of Maine's peatlands. At over 7,000 acres, the Great Heath contains multiple layers of bogs and fens (Figure 6.1.5-2) (MDIFW, 2005).

Palustrine wetlands also include the shallow water zones of lakes, rivers, and ponds and aquatic beds formed by water lilies and other floating-leaved or free-floating plants. These are the least common but easiest wetlands to recognize.

Source: (USFWS, 2010)

Figure 6.1.5-2: Wetland in Great Heath, Mt. Pleasant Isle, Maine

Based on the USFWS NWI 2014 analysis, there are more than 2 million acres of palustrine wetlands in Maine (USFWS, 2014a). PFO/PSS wetlands are the dominant wetland type (87 percent), followed by PEM (10 percent), PUB/PAB (ponds) (3 percent), and other palustrine wetlands make up less than 1 percent (USFWS, 2014a). More than 20 percent of Maine's wetlands were lost due to development, agriculture, and forestry since colonial times. Primary threats within the state include nonpoint source pollution from urbanization, pollutants, habitat fragmentation, and non-native species. (Maine DEP, 2013b)

[65] Circumneutral fen: "Peatland vegetation type is dominated by sedges or grades into dwarf shrubs… peatlands are influenced by calcium rich, circumneutral (rather than acidic) water. The substrate pH is 5.6 or higher" (Maine DACF, 2013a).

[66] Patterned fen: "Peat-forming wetlands that receive nutrients from sources other than precipitation… characterized by parallel ridges of vegetation separated by less productive hollows. The ridges of these patterned fens form perpendicular to the downslope direction of water movement" (USEPA, 2015o).

Estuarine and Marine Wetlands

In Maine, estuarine and marine, or tidal fringe wetlands, can be vegetated (salt and brackish marshes) or unvegetated (mud and tidal flats and reefs), and are found between the open saltwater of the bays throughout the Gulf of Maine and small fringe marshes (Maine DEP, 1996). According to the USFWS Wetlands of the northeast: Results of the National Wetlands Inventory, Maine's irregular rocky shoreline is a good site for marine wetlands. In fact, the state has the "most acreage of marine wetlands, comprising approximately 65 percent of the entire region's marine wetlands." (Tiner, 2010) Of the more than 2 million acres of wetlands in the state, approximately 39,000 acres are estuarine and intertidal marine along the coast (USFWS, 2014a).

Coastal development is the biggest threat to Maine's estuarine and marine wetlands. Permanent structures alter drainage patterns and increase potential for surface runoff with pollutants to flow into the wetlands. Despite regulation under Maine's Mandatory Shoreland Zoning Law, estuarine wetlands continue to decline in the state. A lack of information on the environmental impacts on salt marsh ecosystems and inconsistent enforcement of the Zoning law have restrained restoration efforts. (MDIFW, 2005)

6.1.5.4 Wetlands of Special Concern or Value

In addition to protections under the state's regulations, Maine considers certain wetland communities as areas of special value due to their global or regional scarcity, unusual local importance, or habitat they support. These include "significant vernal pools," which are considered by Maine's NRPA to have valuable habitat and are protected by law.

Significant Vernal Pools

Found throughout Maine, vernal pools are a type of small, temporary wetland present in forested areas, though the pools themselves lack trees. The pools occur in shallow depressions that fill from spring or fall precipitation, and are usually dry by late summer or during droughts since they are not connected to a permanent water source. Vernal pools fill from rain, snowmelt, or groundwater. These small wetlands contribute to storage and filtration of surface water and help recharge aquifers. Vernal pools are fishless, and serve as important breeding habitat for amphibians (salamanders and frogs), including wood frogs (*Lithobates sylvaticus*), spotted and blue-spotted salamanders (*Ambystoma maculatum* and *A. laterale*) and fairy shrimp (*Anostraca sp.*). (Maine DEP, 2009)

In Maine, vernal pools with high value for wildlife are called significant vernal pools, and only significant vernal pools are protected under NRPA. Generally, a vernal pool habitat is significant if it has a high habitat value, either because:

- "a state-listed threatened or endangered species, such as a spotted turtle, or a rare species, such as a ribbon snake, uses it to complete a critical part of its life history, or
- there is a notable abundance of specific wildlife, such as blue spotted salamander, wood frog, or fairy shrimp" (Maine DEP, 2009)

The specific criteria describing a significant vernal pool are listed in DEP Rules, Chapter 335. As of 2015, Maine has not comprehensively mapped significant vernal pools.

"The loss of vernal pools and the critical terrestrial habitat around them leads to local loss of amphibian species, a decrease in biodiversity, and a decline in food available for many other animals that live in these areas" (Maine DEP, 2009).

Other important wetland sites in Maine include:

- Maine Department of Agriculture, Conservation, and Forestry (DACF) designated more than 90,000 acres, (with at least eight percent consisting of wetlands), on 17 public land units, as Ecological Reserves. These lands are reserved by the state to protect their important ecosystems. (Maine DACF, 2013b) More information on the centers is available at www.maine.gov/dacf/mnap/reservesys/index.htm.
- Maine Department of Inland Fisheries and Wildlife (DIFW) manages to approximately 100,000 acres on more than 50 state-owned Wildlife Management Areas (WMAs). Wildlife Management Areas contain many habitats and are available for multiple recreation uses (MDIFW, 2013a). To learn more about state Wildlife Management Areas, visit www.maine.gov/ifw/wildlife/land/index.html.
- Maine's 14 National Natural Landmarks (see Section 6.1.8 for descriptions of Maine's National Natural Landmarks) range in size from 10 acres to thousands of acres, and are owned by The Nature Conservancy, Maine Appalachian Trail Club, National Park Service, universities, and other conservation organizations and individuals (NPS, 2012a). Visit www.nature.nps.gov/nnl/state.cfm?State=ME to learn more about Maine's National Natural Landmarks.
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), example easement holders include Maine Department of Marine Resources, the U.S. Natural Resources Conservation Service, Kittery Land Trust, and Chebeague and Cumberland Land Trust, all of which hold easements in Maine. (NCED, 2015)

6.1.6 Biological Resources

6.1.6.1 Definition of the Resource

This section describes the biological resources of Maine. Biological resources include terrestrial[67] vegetation, wildlife, fisheries and aquatic habitats[68], and threatened[69] and endangered[70] species, and communities and species of conservation concern. Wildlife habitat

[67] Terrestrial: "Pertaining to the land" (USEPA, 2015m).
[68] Habitat: "The place where a population lives, including its living and non-living surroundings" (USEPA, 2015m).
[69] Threatened: "A species that is likely to become endangered if not protected" (USEPA, 2015m).
[70] Endangered: "Animals, birds, fish, plants, or other living organisms threatened with extinction by anthropogenic (man-caused) or other natural changes in their environment. Requirements for declaring a species endangered are contained in the Endangered Species Act" (USEPA, 2015m).

and associated biological ecosystems are also important components of biological resources. Approximately 90 percent of the state is forested with mountain regions, uplands, and coastal lowlands that support a wide diversity of biological resources. Each of these topics is discussed in more detail below.

6.1.6.2 Specific Regulatory Considerations

The proposed project must meet the requirements of NEPA and other applicable laws and regulations. The pertinent federal laws relevant to the protection and management of biological resources in the Maine are summarized in Appendix C. Table 6.1.6-1 summarizes the major federal and Maine state laws relevant to the state's biological resources and the project.

Table 6.1.6-1: Relevant Maine Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Maines' Endangered Species Act	Department of Inland Fisheries & Wildlife	Protection of fish or wildlife found in the state, as well as the ecosystems upon which they depend
Natural Resources Protection Act, 38 M.R.S.A Section 480-A	Maine DEP	Protection of natural resources
Marine Natural Areas Program	Maine DACF	Protection of rare plants, Invasive species control, forest management; Title 38, Section §419-C Prevention of the spread of invasive aquatic plants

6.1.6.3 Terrestrial Vegetation

The distribution of flora[71] within the state is a function of the characteristic geology,[72] soils, climate, and water of a given geographic area and correlate to distinct areas identified as ecoregions[73]. 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) (USDA, 2015) (World Wildlife Fund, 2015).

Ecoregion boundaries often coincide with physiographic 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 lower 48 states has 84 ecoregions. This section presents a discussion of biological resources for Maine at USEPA Level III (USEPA, 2015c).

[71] Flora: "Plant population of a particular region (USEPA, 2015m).
[72] 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.
[73] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables (USEPA, 2015m).

As shown in Figure 6.1.6-1, the USEPA divides Maine into three Level III ecoregions with two ecoregions occupying approximately 90 percent of the total area. These ecoregions support a variety of different plant communities; all predicated on their general location within the state. Communities range from coniferous and hardwood communities in the northern mountains, to coastal communities in the south. According to Maine's Comprehensive Wildlife Conservation Strategy, Maine can be further divided into 15 ecoregions; however, for the purposes of the discussion here regions will be commonly referred to as "coastal" or "inland." Inland regions include Aroostook County, Maine Highlands, Kennebec, and Lakes and Mountains. Coastal regions include Down East, Mid Coast, Southern Coast, and Greater Portland.

Table 6.1.6-2 provides a summary of the general abiotic characteristics, vegetative communities, and the typical vegetation found within each ecoregion found in Maine.

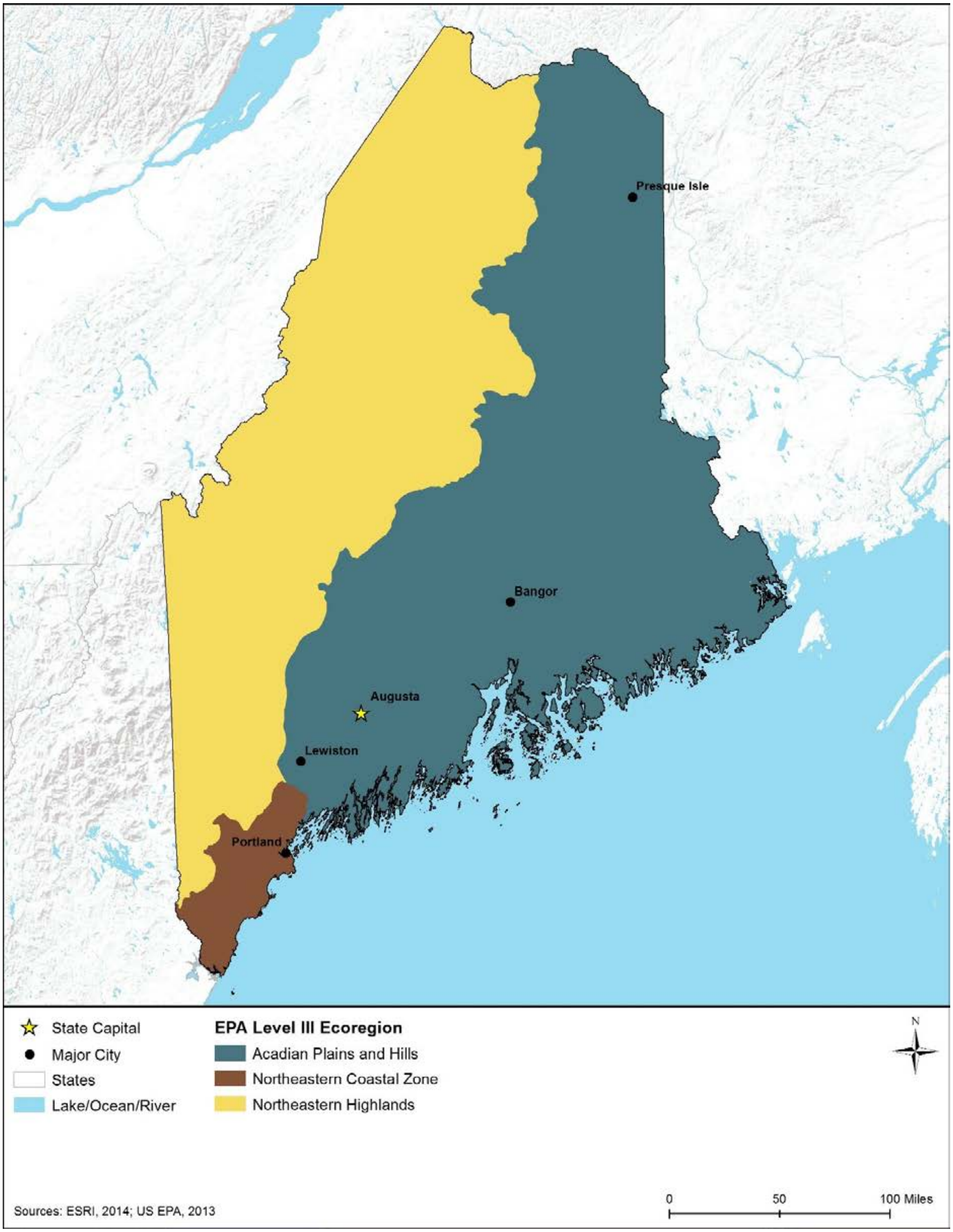


Figure 6.1.6-1: Level III Ecoregions in Maine

Table 6.1.6-2: USEPA Level III Ecoregions of Maine

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities
58	Northeastern Highlands	Composed mostly of forested hills and mountains on nutrient poor soils, with numerous high-gradient streams and glacial[74] lakes	Maple-Beech-Birch; Spruce-Fir; Oak-Hickory
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
82	Acadian Plains and Hills	Mostly forested with many continental glacial lakes	Spruce-fir, maple, beech birch

Source: (Bryce, et al., 2010) (Elias, 1989) (USEPA, 2013c) (Petrides, 1986)

Communities of Concern

In addition to the USEPA designations, Maine's Natural Areas Program (MNAP) has defined 104 different natural community types that cover the states landscapes including communities of concern (MNAP, 2016a). Each natural community type is assigned a rarity rank, with 1 being rare, and 5 being common. Maine also maintains a list of conservation habitats, essential habitats, and protected habitats all with varying levels of regulatory oversight. The Department of Conservation provides biennial updates of the official list of Maine's endangered and threatened plants (Maine DACF, 2013b).

Communities are determined to be noteworthy if they are rare in Maine, or because they are vulnerable to extirpation in Maine. MNAP is particularly interested in any example of a natural community type ranked S1, S2, or S3, and outstanding examples (e.g., large, old growth stands) of S4 and S5 types. Maine Appendix A, Table A-1 summarizes the rarest terrestrial plant communities found in Maine, defined as those with a state rank of S1 (Maine DACF, 2013b).

Maine also maintains several habitat protection designations, including essential habitat, significant wildlife habitat, and conservation priority lands.

Essential Habitat is designated for Threatened or Endangered designated species and has been mapped by MDIFW. Essential Habitat includes: roseate tern (*Sterna dougallii*), nesting area and piping plover (*Charadrius melodus*) and least tern (*Sternula antillarum*) nesting, feeding, and brood-rearing areas (MDIFW, 2015a). See discussion below for more information.

Significant Wildlife Habitat has been defined under Maine's Natural Resource Protection Act and includes seabird nesting islands, significant vernal pools, waterfowl and wading bird habitat, shorebird nesting, feeding, and staging area, and deer wintering areas (MDIFW, 2006).

Conservation priority lands have been established and mapped and can be characterized by the level of biodiversity protection they provide. Conservation lands are legally protected. Three

[74] Glacial: "Of or pertaining to distinctive processes and features produced by or derived from glaciers and ice sheets" (USEPA, 2015m).

protection status levels have been established that permanently protect those lands. In addition, Maine has more than 90,000 acres of Ecological Reserve areas that are also protected under state law. (MNAP, 2016b) (MNAP, 2016c)

Nuisance and Invasive Plants

Nuisance and invasive plants is a broad category that includes a large number of undesirable plant species that have the potential to be directly or indirectly impacted by the project. Direct impacts to nuisance and invasive plants may be beneficial to the environment, but oftentimes, 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 could perpetuate a disturbance regime that allows for 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, forest management, natural, and other open areas (U.S. Legal, 2015). The United States 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 30, 2014, there are 112 noxious weed species have been catalogued in the United States (88 terrestrial, 19 aquatic, and 5 parasitic) (USDA, 2014).

Maine enacted a prevention of the spread of invasive aquatic plants statute in 1999, which currently identifies 11 aquatic species. Aquatic invasive species are discussed in Section 6.2.1.5 below. MNAP provides a list of nonregulated terrestrial invasive plants in addition to the regulated aquatic species, some of which are federal noxious weeds. Nonregulated terrestrial invasive plants include the below species (The University of Maine, 2015):

- Shrubs – autumn olive (*Elaegnus umbellata*), burning bush (*Euonymus alatus*), common buckthorn (*Frangula alnus*), glossy buckthorn (*Rhamnus cathartica*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), Russian olive (*Elaegnus angustifolia*),
- Terrestrial Forbs, Grasses, and Vines – Asiatic bittersweek (*Celastrus orbiculata*), black swallowwort (*Cynanchum louisae*), common reed (*Phragmites australis*), garlic mustard (*Alliaria petiolate*), giant hogweed (*Heracleum mantegazzianum*), bush honeysuckles (*Lonicera sp*), Japanese honeysuckle (*Lonicera japonica*), Japanese knotweed (*Fallopia japonica*), Japanese stilt grass (*Microstegium vimeineum*), lesser celandine (*Ranunculus ficaria*), mile-a-minute weed (*Polygonum perfoliatum*), porcelainberry (*Ampelopsis brevipedulanculata*), purple loosestrife (*Lythrum salicaria*)
- Other – sudden oak death (*Phytophthora ramorum*)

6.1.6.4 Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Maine, divided among mammals[75], birds[76], reptiles and amphibians[77], and invertebrates[78]. Terrestrial wildlife are those species of animals, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals and furbearers[79], nongame animals, and game birds and waterfowl and their habitats that may be found in Maine. A discussion of non-native and/or invasive 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. There are 58 mammal species that currently live within Maine, 292 species of birds, 35 reptile and amphibian species, and over 16,000 species of invertebrates.

Mammals

Maine has a wide variety of mammals because of its geographic location and has one of the largest moose and black bear population in the Lower 48 states (MDIFW, 2013b). A total of 58 species of wild mammals currently live within the Maine. Common and widespread mammal species include chipmunks, squirrels, mice, voles, lemmings, bats, fox, coyote, moose, bear, and deer.

State species of special concern include the eastern small-footed myotis (*Myotis leibii*), little brown bat (*Myotis lucifugus*), the northern long-eared myotis (*Myotis septentrionalis*), red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionyceterus noctivigans*), eastern pipistrelle, recently re-named the tri-colored bat (*Perimyotis subflavus*), gray wolf (*Canis lupus/lycaon*), Canada lynx (*Lynx canadensis*), and Penobscot meadow vole (*Microtus pennsylvanicus shattucki*). A number of threatened and endangered mammals are located in Maine. Section 6.1.6.6, Threatened and Endangered Species, identifies these protected species.

Birds

Maine has a diverse landscape and therefore a variety of habitats that support various bird species. Approximately 292 species of bird occur in suitable habitats within Maine. Bird species include upland gamebirds, waterfowl, wading birds, raptors, seabirds, shorebirds, and songbirds can be found within the state. Many of the bird species found in Maine undertake long

[75] Mammals: "Warm-blooded vertebrates that give birth to and nurse live young; have highly evolved skeletal structures; are covered with hair, either at maturity or at some stage of their embryonic development; and generally have two pairs of limbs, although some aquatic mammals have evolved without hind limbs" (USEPA, 2015m).

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

[77] Amphibian: "A cold-blooded vertebrate that lives in water and on land. Amphibians' aquatic, gill-breathing larval stage is typically followed by a terrestrial, lung-breathing adult stage" (USEPA, 2015m).

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

[79] Furbearer is the name given to mammals that traditionally have been hunted and trapped primarily for fur.

distance migrations, such as shorebirds, while others demonstrate irregular seasonal movements, and a few species are year-round residents with very small home ranges (MDIFW, 2013c).

Upland game birds found in Maine are limited to two species, the ruffed grouse (*Bonasa umbellus*) and the wild turkey (*Meleagris gallopavo*). Both of these species are year-round residents (MDIFW, 2013d).

There are 34 species of waterfowl found in Maine, including 15 species that are residents during breeding season, and 18 species that spend winter in Maine. All 34 species migrate through Maine. Species include a variety of ducks (including dabbling ducks, diving ducks, and sea ducks) and geese (MDIFW, 2013e).

Wading birds of Maine include herons, egrets, ibises, bitterns, moorhens, coots, rails, and sandhill cranes. Several bird species have been listed as Endangered, Threatened, or of Special Concern (MDIFW, 2013f). These special status species are discussed in detail in Section 6.1.6.6.

Raptors found in Maine include several species of eagles, falcons, northern harriers, osprey, woodland hawks, vultures, and owls (MDIFW, 2013g).

There are between 3,000 and 4,000 islands and ledges off the coast of Maine that offer a wide range of habitats for nesting seabirds. Seabirds in Maine include Leach's storm petrel (*Oceanodroma leucorhoa*), great cormorant (*Phalacrocorax carbo*), double-crested cormorant (*Phalacrocorax auritus*), laughing gull (*Leucophaeus atricilla*), herring gull (*Larus argentatus*), great black-backed gull (*Larus marinus*), common tern (*Sterna hirundo*), arctic tern (*Sterna paradisaea*), roseate tern (*Sterna dougallii*), razorbill (*Alca torda*), black guillemot (*Cepphus grille*), and the Atlantic puffin (*Fratercula arctica*) (MDIFW, 2013h).

Thirty-eight shorebird species can be found at some point during their lifecycle in Maine, with more than 20 species of shorebirds feeding and resting in Maine's coastal habitats. Shorebird populations have been and are currently in decline (MDIFW, 2013c). Shorebirds include plovers, sandpipers, turnstones, curlews, knots, dowitchers, and phalaropes (MDIFW, 2013i).

Over 100 species of songbirds can be found in Maine including the Downy woodpecker (*Dryobates pubescens*), Ruby-throated hummingbird (*Archilochus colubris*), tufted titmouse (*Baeolophus bicolor*), and grasshopper sparrow (*Ammodramus savannarum*). Songbirds in Maine are protected under the Migratory Bird Treaty Act. A few species are also listed as Endangered or Threatened (MDIFW, 2013j). A discussion of Threatened and Endangered species is included in Section 6.1.6.6 below.

Maine 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 (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. With Maine being the largest and most sparsely populated state in New England, it represents a significant portion of the breeding range for many species (Maine Audubon, 2016). Maine's Audubon maintains a list of over 45 birding sites in Maine with the most popular stopover site being Monhegan Island. Monhegan Island is located 10 miles offshore along the mid-coast of Maine and is well known for its neotropical migrant songbird migration in the fall (DeSorbo, Wright, Johnson, & Gray, 2012).

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 throughout the year, with more frequent sightings along the southeastern region of the state following the coast (eBird, 2015a). Golden eagles are generally found in mountains and cliffs. Golden eagles are rarely observed within the state, with rare sightings during winter months (eBird, 2015b).

Twenty two Important Bird Areas (IBAs) have also been identified in Maine. 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 environmentalists, and birders. Figure 6.1.6-2 illustrates these IBAs link global and continental bird conservation priorities to local sites that provide critical habitat[80] for native bird populations. The IBAs have been identified in Maine primarily along the coast and around wetlands (Gallo, Hodgeman, & Camuso, 2008).

Reptiles and Amphibians

A total of 35 native reptile and amphibian species, such as sea turtles, snakes, and salamanders, occur in Maine including 17 species of salamanders, newts, frogs, and toads, and 18 species of turtles and snakes (Society, 2016). Habitats vary from upland woodlands, farmlands, meadows, and wetlands/freshwater systems. Section 6.1.6.6 provides a summary on Threatened and Endangered Species.

Invertebrates

Maine is home to over 16,000 species of terrestrial and freshwater invertebrate species, including bees, hornets, wasps, butterflies, moths, beetles, flies, dragonflies, damselflies, spiders, mites, crustaceans, and nematodes (MDIFW, 2013k). These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. In the United States, 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.

[80] 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, 2015m) .

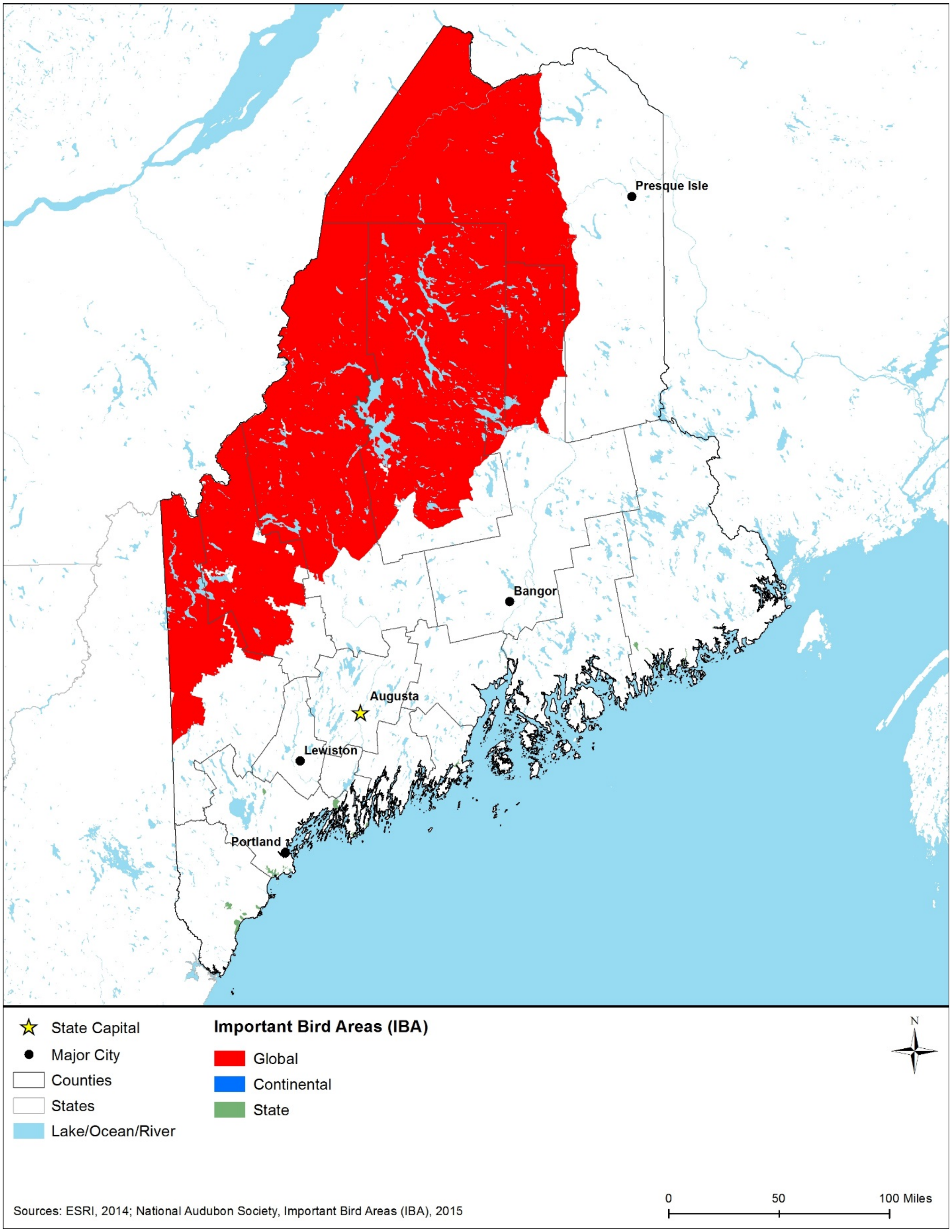


Figure 6.1.6-2: Important Bird Areas in Maine

Invasive Wildlife Species

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.

There 10 terrestrial invertebrate pest species common in Maine including the European Fire Ant (*Myrmica rubra*), the gypsy moth (*Lymantria dispar*), the Spotted wing drosophilia (*Drosophyilia suzukii*), the emerald ash borer (*Agrilus planipennis*), Asian longhorn beetle (*Anoplorhora glabripennis*), hemlock wooly adelgid (*Adelges tsugae*), elongate hemlock scale (*Fiorinia externa*), brown spruce longhorn beetle (*Tetropium fuscum*), winter moth (*Operopthtera brumata*), and European wood wasp (*Sirex noctilio*) (The University of Maine, 2015).

6.1.6.5 Fisheries and Aquatic Habitats

This section discusses the aquatic wildlife species in Maine, 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 Maine's fish are diadromous (i.e., anadromous[81] and catadromous[82]), reflecting the state's location along the Atlantic coast and the variety of aquatic habitats it provides. This area includes open ocean, estuaries, bays, inlets, and other coastal features that provide habitat for a multitude of wildlife.

Freshwater Fish

According to the Maine DEP, Maine has over 7,700 miles of rivers; more than 30,000 miles of streams; and approximately 32,000 lakes, ponds, and reservoirs (Maine DEP, 2012a). In total, there are 56 known species of freshwater fish including 37 native species and 19 introduced species (MDIFW, 2002). A brief description of each of the freshwater fish families is provided below.

Coldwater Game Fish: Coldwater game fish include cusk (*Lota lota*[83]), rainbow smelt (*Osmerus mordax*), trout/salmon (*Salmonidae sp.*), and lake whitefish (*Coregonus clupeiformis*). Atlantic salmon (*Salmo salar*) are discussed further in Section 6.1.6.6, Threatened and Endangered Species.

Warmwater Game Fish: Warmwater game fish include bass, black crappie (*Pomoxis nigromaculatus*), brown bullhead (*Ameriurus nebulosus*), chain pickerelel (*Esox niger*), muskellunge (*Esox masquinongy*), northern pike (*Esox lucius*), perch, and sunfish (*Mola mola*).

[81] 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, 2015m).

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

[83] Note that the Maine Department of Inland Fisheries and Wildlife identifies the cusk as "*Lota lota*," referring to a freshwater species (http://www.maine.gov/ifw/fishing/species/identification/cusk.htm). However, the NMFS's Office of Protected Species uses the common name cusk to refer to the species *Brosme brosme,* a saltwater fish. (http://www.nmfs.noaa.gov/pr/species/fish/cusk.htm).

Sucker: Maine is home to three sucker species including the common sucker (*Catostomus commersonii*), the creek chub sucker (*Erimyzon oblongus*), and the longnose sucker (*Catostomus catosomus*).

Minnows: Minnow species include chubs (*Semotilus atromaculatus*), dace (*Chrosomus eos*), fallfish (*Semotilus corporalis*), flathead minnow (*Pimephales promelas*), and shiners.

Other: Other fish species include darters, sticklebacks (*Gasterosteidae sp.*), and the American eel (*Anguilla rostrata*).

Saltwater Fish

The Gulf of Maine is located off the shores of Maine and includes southeastern Canada to the north and coastal New England to the south. The dramatic topography found in the Gulf of Maine creates ideal conditions for diverse marine life and is composed of one of the most biologically productive marine ecosystems in the world (New England Coastal Wildlife Alliance, 2015).

Maine's most common saltwater fish species include alewife (*Alosa pseudoharengus*), American Pollock (*Pollachius pollachius*), American shad (*Alosa sapidissima*), Atlantic cod (*Gadus morhua*), Atlantic halibut (*Hippoglossus hippoglossus*), Atlantic herring (*Clupea harengus*), Atlantic mackerel (*Scomber scombrus*), Atlantic Menhaden (*Brevoortia tyrannus*), Atlantic redfish (*Sebastes mentella*), Atlantic salmon (*Salmo salar)*, Atlantic sturgeon (*Acipenser oxyrhynchus*), black sea bass (*Centropristis striata*), blue shark (*Prionace glauca*), bluefin tuna (*Thunnus thynnus*), bluefish (*Pomatomus saltatrix*), browntrout (*Salmo trutta*), cunner (*Tautogolabrus adspersus*), cusk (*Brosme brosme*), goosefish (*Lophius americanus*), haddock (*Melanogrammus aeglefinus*), little skate (*Leucoraja erinacea*), longhorn sculpin (*Myoxocephalus octodecemspinosus*), ocean pout (*Zoarces americanus*), porbeagle shark (*Lamna nasus*), rainbow smelt (*Osmerus mordax*), sea raven (*Hemitripteridae*), shortfin mako shark (*Isurus oxyrinchus*), silver hake (*Merluccius bilinearis*), spiny dogfish (*Squalus acanthias*), striped bass (*Morone saxatilis*), tautog (*Tautoga onitis*), thresher shark (*Alopias sp.*), white shark (*Carcharodon carcharias*), winter flounder (*Pseudopleuronectes americanus*), and wolfish (*Anarhichas lupus*). Many saltwater fish species are well known for their recreational and commercial fishing value.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management 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" (EFH). The National Oceanic and Atmospheric Administration (NOAA) Fisheries provides an online mapping application[84] and website[85] to provide the public a means to obtain illustrative representations of EFH. When assessing site-specific projects locations, this tool can be used to identify the potential for any

[84] http://www.habitat.noaa.gov/protection/efh/efhmapper/index.html
[85] http://www.greateratlantic.fisheries.noaa.gov/hcd/list.htm

conflicts between project activities and sensitive resources. Table 6.1.6-3 presents a summary of EFH offshore of Maine.

Table 6.1.6-3: Essential Fish Habitat Offshore of Maine

Common Name	Eggs	Larvae/YOY[86]	Juveniles	Adults
Atlantic cod	Various locations	Various locations	Various locations	Various locations
Atlantic halibut	Few scattered locations	NA	Various locations	Various locations
Atlantic herring	Few scattered locations	Various locations	Various locations	Various locations
Atlantic mackerel	Few scattered locations from central portion of the state to the south	Few scattered locations from central portion of the state to the south	Various locations	Various locations
Atlantic wolfish	Species present offshore of Maine; however life stage data was not available	Species present offshore of Maine; however life stage data was not available	Species present offshore of Maine; however life stage data was not available	Species present offshore of Maine; however life stage data was not available
Barndoor skate	NA	NA	Not Designated at this location	Few scattered locations
Bluefish	Not Designated at this location	Not Designated at this location	All major estuaries	All major estuaries
Haddock	Few scattered locations	Few scattered locations	Few scattered locations	Few scattered locations
Little skate	NA	NA	Few scattered locations	Few scattered locations
Longfin inshore squid	Not Designated at this location	NA	Not Designated at this location	Along most offshore areas
Monkfish	Gulf of Maine	Gulf of Maine	Gulf of Maine	Gulf of Maine
Northern shortfin squid	NA	NA	NA	Inshore and offshore waters of the Gulf of Maine
Ocean pout	Various locations	Various locations	Various locations	Various locations
Offshore hack	Not Designated at this location	Discrete locations	Not Designated at this location	Not designated at this location
Pollock	Various locations	Various locations	Various locations	Various locations
Red hake	Gulf of Maine	Gulf of Maine	Gulf of Maine	Gulf of Maine
Redfish	Species present offshore of Maine; however life stage data was not available	Species present offshore of Maine; however life stage data was not available	Species present offshore of Maine; however life stage data was not available	Species present offshore of Maine; however life stage data was not available
Silver hake	Gulf of Maine	Gulf of Maine	Gulf of Maine	Gulf of Maine
Smooth skate	NA	NA	Scattered locations	Scattered locations
Spiny dogfish	NA	NA	Various locations	Various locations
Thorny skate	NA	NA	Gulf of Maine	Gulf of Maine
White hake	Gulf of Maine	Gulf of Maine	Gulf of Maine	Gulf of Maine

[86] 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, 2015m).

Common Name	Eggs	Larvae/YOY[86]	Juveniles	Adults
Window pane flounder	Gulf of Maine	Gulf of Maine	Gulf of Maine	Gulf of Maine
Winter flounder	Gulf of Maine	Gulf of Maine	Gulf of Maine	Gulf of Maine
Winter skate	NA	NA	Few scattered locations	NA
Yellowtail flounder	Gulf of Maine	Gulf of Maine	Gulf of Maine	Gulf of Maine
Porbeagle shark	Gulf of Maine	Gulf of Maine	Gulf of Maine	Gulf of Maine
Basking shark	NA	NA	Gulf of Maine	Gulf of Maine
Blue shark	NA	NA	Gulf of Maine	Gulf of Maine
Common thresher shark	NA	NA	NA	Gulf of Maine
Shortfin mako shark	NA	NA	NA	Gulf of Maine
White shark	NA	NA	NA	Gulf of Maine
Bluefin tuna	NA	NA	NA	Gulf of Maine

Source: (NOAA, 2016a)

Shellfish and Other Invertebrates

Maine is home to both freshwater and marine shellfish and other invertebrates. A multitude of marine shellfish and other invertebrate species can be found offshore of Maine including clams, oysters, scallops, mussels, periwinkles, worms, whelks, cephalopods (such as squid and octopi), crab, barnacles, amphipods (such as the beach flea), shrimp, lobster, starfish, sea urchins, sea cucumber, sand dollar, sea squirts, chiton, and worms. Maine's shellfish and other invertebrate species are vitally important and are both recreationally and commercially harvested. (MDMR, 1993)

In addition to marine species, Maine is also home to several species of freshwater shellfish and numerous freshwater invertebrates. A third of the U.S. freshwater mussel species have become extinct or are in danger of becoming extinct and 75 percent of the mussel population in the U.S. is listed and endangered, threatened or of special concern (MDIFW, 2013l). Maine has not lost any freshwater mussel species; however, several species are recognized as protected by state agencies.

Marine Mammals

All marine mammals (i.e., whales, dolphins, porpoises, seals, and sea lions) are protected under the Marine Mammal Protection Act (MMPA). A subset of these mammals is also protected under the Endangered Species Act (ESA). This section briefly introduces the marine mammal species found in Maine waters.

Many whale species occur in the Gulf of Maine 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 occurrences. Their presence offshore is often unnoticed because of their transient nature and deep ocean preference. Species that make their way through the Gulf of Maine waters include the blue whale (*Balaenoptera musculus*), Bryde's whale (*Balaenoptera brydei*), the finback whale (*Balaenoptera physalus*), the minke whale (*Balaenoptera acutorostrata*), sei whale (*Balaenoptera borealis*), northern right whale (*Eubalaena glacialis*), humpback whale

(*Megaptera novaeangliae*), beluga whale (*Delphinapterus leucas*), beaked whale (*Hyperoodonitade*), false killer whale (*Pseudorca crassidens*), northern bottlenose whale (*Hyperoodon ampullatus*), pygmy sperm whale (*Kogia breviceps*), short-finned pilot whale (*Globalicephala*), long finned pilot whale (*Globicephala melas*), and sperm whale (*Physeter microcephalus*).

A few species of whales exhibit distinctive behaviors. In contrast to migratory patterns displayed by other whale species, minke whales 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 feed far offshore in the open ocean and are unlikely to approach nearshore areas.

In addition, many species of seals, dolphins, and porpoises occur in the Gulf of Maine including harbor seal (*Phoca vitulina*), ringed seal (*Pusa hispida*), harp seal (*Pagophilus groenlandicus*), gray seal (*Halichoerus grypus*), hooded seal (*Cystophora cristata*), Atlantic spotted dolphin (*Stenella frontalis*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), bottlenose dolphin (*Tursiops truncates*), common dolphin (*Delhinus sp.*), harbor porpoise (*Phocoena phocoena*), grampus-risso's dolphin (*Grampus griseus*), spinner dolphin (*Stenella longirostis*), spotted dolphin (*Stenella frontalis*), striped dolphin (*Stenella coeruleoalba*), white-beaked dolphin (*Lagenorhynchus albirostris*). Harp seals and hooded seals normally prefer deep seas and thick ice to rest upon; gray seals prefer strong currents and bask along rocky shores of temperate waters (Burt, 1976).

Sea Turtles

Three species of sea turtles occur in U.S. waters off the coast of Maine, all of which are protected under the ESA. For more information on sea turtles, refer to Section 6.1.6.6.

Invasive Aquatic Species

Maine's Department of environmental protection regulates 11 aquatic plant species under §410-N Title 38 Chapter 3 Subchapter 1 including the Brazilian elodea (*Egeria densa*), yellow floating heart (*Nymphoides peltata*), European frogbit (*Hydrocharis morsus-ranae*), variable-leaf milfoil (*Myriophyllum heterophylum*), curly leaf pondweed (*Potamogeton crispus*), Eurasian milfoil (*Myriophyllum spicatrum*), fanwort (*Cabomba sp.*), hydrilla (*Hydrilla*), parrot feather (*Myriophyllum aquaticum*), European naidad (*Najas minor*), and water chestnut (*Eleocharis dulcis*). In addition, it is prohibited for a person to transport any aquatic plant or parts of any aquatic plant.

Nonregulated marine invaders include the Asian shore crab (*Hemigrapsus sanguineus*), dead mans fingers (*Codium fragile*), lacy crust bryozoan (*Membranipora membranacea*), green crab (*Carcinus maenas*), hairy-clawed shore crab (*Hemigrapsus penicillatus*), Chinese mitten crab (*Eriocheir sinensis*), common periwinkle (*Littorina littorea*), rapa whelk (*Rapana vensosa*) (UoM 2015). The northern pike (*Esox lucius*) is the only non-regulated fish species according to the Maine Invasive Species Netwok (The University of Maine, 2015).

6.1.6.6 *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 Maine. The USFWS has identified five federally endangered[87] and seven federally threatened species[88] known to occur in Maine (USFWS, 2015c)[89]. Of these, two have designated critical habitat within the state[90] (USFWS, 2015d). The 12 federally listed species include two mammals, three reptiles, three birds, one fish, and three plants. These species are discussed in detail under the following sections (USFWS, 2015c). Figure 6.1.6-3 depicts the designated critical habitat for Canada lynx (*Lynx canadensis*) and Atlantic salmon (*Salmo salar*) in Maine.

Mammals

Two threatened species are federally listed for Maine as summarized in Table 6.1.6-4. The Canada lynx (*Lynx canadensis*) is found in remote areas of northern Maine. The northern long-eared bats (*Myotis septentrionalis*) can be found throughout the state. Information on the habitat, distribution, and threats to the survival and recovery of both of these species in Maine is provided below.

Table 6.1.6-4: Federally Listed Mammal Species of Maine

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Canada Lynx	*Lynx canadensis*	T	Yes, portions of seven counties	Boreal forest in the northern half of the state
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Live trees and snags; caves and abandoned mines found throughout the state

[a] E = Endangered, T = Threatened
Source: (USFWS, 2015c), (USFWS, 2013a)

[87] Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range" (16 U.S.C §1532(6)).
[88] Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C §1532(20)).
[89] Note that the National Marine Fisheries Service (NMFS) states that the Gulf of Maine Distinct Population Segment (DPS) for the Atlantic Sturgeon (http://www.nmfs.noaa.gov/pr/pdfs/species/atlanticsturgeon_gulfofmaine_dps.pdf) is endangered and states that humpback whales may feed in the Gulf of Maine in the summer (http://www.fisheries.noaa.gov/pr/species/mammals/whales/humpback-whale.html). NMFS also states that the shortnose sturgeon has been documented in several places in Maine (http://www.fisheries.noaa.gov/pr/species/fish/shortnose-sturgeon.html). However, the USFWs does not list these species in Maine; therefore, they are not discussed in this document.
[90] Critical habitat includes "the specific areas (i) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species" (16 U.S.C §1532(5)(A)) (USEPA, 2015p).

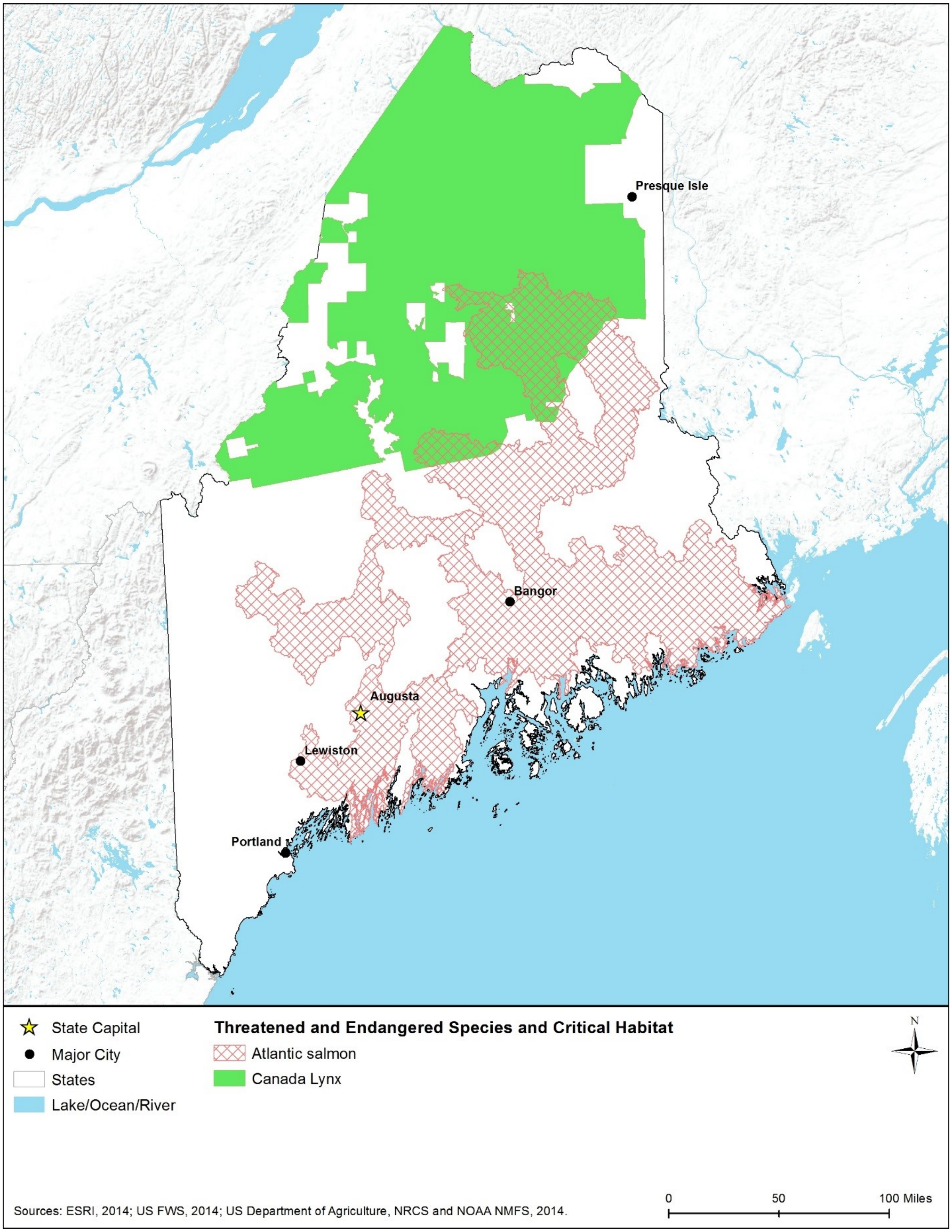


Figure 6.1.6-3: Mapped Critical Habitat for Canada Lynx and Atlantic Salmon in Maine

Canada Lynx. The Canada lynx (*Lynx canadensis*) is a medium-sized cat generally measuring 30-35 inches and weighing 14 to 31 pounds. They have large furry paws adapted to walking on snow, long legs, tufts on the ears, and black-tipped tails (USFWS, 2014b). The Canada lynx is a secretive forest-dwelling cat, common throughout the boreal forest of Alaska and Canada, but rare in the lower 48 states. The Canada lynx was first listed as threatened in 2000 (65 FR 16053 16086, March 24, 2000). Lynx populations were thought to have peaked in 2006 with between 750 to 1,000 animals in Maine though total species populations have been difficult to approximate (USFWS, 2013a) (USFWS, 2014b).

Lynx are strongly associated with moist, cool, boreal spruce-fir forests with dense understory vegetation that provides food and cover, especially during periods of deep powdery snow, which limits competition from other hare predators (USFWS, 2013a). Northern Maine industrial forestlands support the largest population in the continental United States. There, clearcut logging practices in the 1970s and 1980s created the extensive, dense spruce and fir forest present today. Young, regenerating boreal forests in Aroostook, Franklin, Oxford, Penobscot, Piscataquis, Somerset, and Washington Counties support high populations of snowshoe hares, which comprise the majority of the lynx diet and was federally listed as critical habitat in 2014 (USFWS, 2013a) (USFWS, 2014b).

Threats facing the Canada lynx include fragmented habitat with restricted connectivity to boreal forests, kills from vehicular traffic, and reduced seasonal snowfall (USFWS, 2007).

Northern Long-eared Bat. The northern long-eared bat (*Myotis septentrionalis*) is a medium-sized (3 to 3.7 inches in length), brown furred, insectivorous bat with long ears, relative to other members of the genus *Myotis*. It was listed as threatened in 2015 (80 FR 17973 18033, April 2, 2015). In the U.S., its range includes most of the eastern and north central states (USFWS, 2015e). In summer, their range includes all 16 counties in the state (USFWS, 2015f).

This species hibernates in caves and mines that exhibit constant temperatures, high humidity, and no air currents. In the summer, they roost singly or in colonies beneath bark, or in crevices or cracks of both live and dead trees. Although mating occurs in the fall, fertilization occurs following hibernation. Pregnant females then migrate to summer areas where they roost in small colonies (USFWS, 2015f).

White Nose Syndrome is the leading cause for the decline of this species. This disease affects hibernating bats in winter with a white fungus (*Geomyces destructans*) on their muzzles. The numbers of northern long-eared bats in hibernacula has decreased by 99 percent in the northeast U.S. The first cases of White Nose Syndrome in Maine was discovered in May 2011. 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, and wind farm operations. (MDIFW, 2013m)

Birds

One endangered and two threatened birds are federally listed for Maine as summarized in Table 6.1.6-5. The piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), and the roseate tern (*Sterna dougallii)* have habitat in the coastal dunes along the Gulf in southern

Maine. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Maine is provided below.

Table 6.1.6-5: Federally Listed Bird Species of Maine

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Piping Plover	*Charadrius melodus*	T	No	Coastal areas of the Gulf of Maine
Red Knot	*Calidris canutus rufa*	T	No	Coastal areas of the Gulf of Maine
Roseate Tern	*Sterna dougallii*	E	No	Coastal areas of the Gulf of Maine

[a] E = Endangered, T = Threatened
Source: (USFWS, 2015g), (USFWS, 2015h), (USFWS, 2011)

Piping Plover. The piping plover (*Charadrius melodus*) is a small, stocky, sand-colored shorebird, listed as endangered in 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, Virgin Islands (50 FR 50726 50734, Dec 11, 1985). 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, 2015g).

Piping plovers breed in three geographic regions of North America, composed of two separate subspecies. Those breeding on the Atlantic Coast of the U.S. and Canada are of the subspecies *C. m. melodus*, whereas the other subspecies, *C. m. circumcinctus*, includes two distinct populations, one which breeds on the Northern Great Plains of the U.S. and Canada, and the other which breeds on the Great Lakes (USFWS, 2015i).

The subspecies *C. m. melodus*, breeds on Maine's coastal beaches, arriving in early April and remain until September when they migrate to coastal areas between North Carolina, Mexico, and the Caribbean. This species spends the majority of the year, up to 10 months, on these migration and winter grounds. Their nests are located between the primary dune and high tide line (MDIFW, 2012).

Current threats to this species include habitat loss and habitat degradation, human disturbance, pets, predation[91], flooding from coastal storms, and environmental contaminants (USFWS, 2015g).

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

Red Knot

Photo Credit: USFWS

Red Knot. Federally listed as a threatened species in 2014 (79 FR 73705 73748, Dec 11, 2014), the Red Knot (*Calidris canutus rufa*) is a large sandpiper that flies in large flocks along the Maine Bay and the Atlantic coast each spring, stopping over during the spawning season for the horseshoe crab (*Limulus polyphemus*). Mussel beds are also an important food source. 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 fly more than 9,300 miles from south to north every spring and return south in autumn. In Maine, Red Knots are observed primarily during migration periods when they are moving either to or from their breeding areas in the Canadian Arctic. Threats to the Red Knot include sea level rise; coastal development; shoreline stabilization; dredging; reduced food availability at their migration stopovers; and disturbance by humans, dogs, vehicles, and climate change (USFWS, 2015h).

Roseate Tern. The roseate tern (*Sterna dougallii*) 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. Listed as endangered in 1987 in the Northeast region and threatened in the southeast region (52 FR 42064 4206, November 2, 1987), the roseate tern is a marine bird that breeds along the coasts of the Atlantic, Pacific, and Indian Oceans on salt marsh islands and beaches with sparse vegetation. In eastern North America, the roseate tern breeds from the Canadian maritime provinces south to New York (USFWS, 2011). In Maine, the roseate tern is known to nest in the southern coastal counties of Cumberland, Hancock, Know, Lincoln, Sagadahoc, Washington, and York (USFWS, 2015j). Present threats include vegetation changes in breeding areas, competition with gulls for suitable nest sites, and predation (USFWS, 2011).

Reptiles

Two endangered and one threatened reptiles are federally listed for Maine as summarized in Table 6.1.6-6. The Green Sea Turtle (*Chelonia mydas)*, Hawksbill Sea Turtle (*Eretmochelys imbricate)*, and Leatherback Sea Turtle (*Dermochelys coriacea)* are pelagic species which migrate between the tropical waters of the Caribbean to the Gulf of Maine.

Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Maine is provided below.

Table 6.1.6-6: Federally Listed Reptile Species of Maine

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Green Sea Turtle	*Chelonia mydas*	T	No	Shallows of the Gulf of Maine
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	No	Gulf of Maine
Leatherback Sea Turtle	*Dermochelys coriacea*	E	No	Gulf of Maine

[a] E = Endangered, T = Threatened
Source: (USFWS, 2015k) (USFWS, 2015l) (USFWS, 2015m)

Sea Turtles (General). As water temperatures rise in the spring, sea turtles begin moving northward, arriving in Virginia's waters around April and May, New York in late June, and then continuing northward to New England in July. The Greater Atlantic Region provides important foraging and developing areas for sea turtles. These movements are reversed when sea turtles leave New England in the fall and head back south to tropical waters. Sea turtles typically lay their eggs on tropical beaches and then migrate northward into temperate waters. (The hawksbill sea turtle is a rare visitor to the northeast.)

Green Sea Turtle. The green sea turtle (*Chelonia mydas*) 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 32811, Jul 28, 1978) whereas all other populations were listed as threatened (NOAA, 2015d). They are found in the shallow waters (except during migration) of shoals, bays, lagoons reefs, and inlets, often where submerged aquatic vegetation exists, from Maine south to Florida, and throughout the Gulf of Mexico and the Caribbean Sea (USFWS, 2015k). Green sea turtles use three primary types of habitat – beaches for nesting, open ocean convergence zones[92], and coastal areas for bottom feeding. Whereas hatchlings consume both plants and animals, adult green sea turtles eat plants only (NOAA, 2015d).

Breeding takes places in subtropical to tropical oceans every two, three, or four years between June and September, with peak nesting in June and July (USFWS, 2015k). Hatching usually occurs at night, and many green sea turtle hatchlings seek refuge and food in masses of floating sea plants (USFWS, 2015k).

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, 2015k).

Hawksbill Sea Turtle. The hawksbill sea turtle (*Eretmochelys imbricata*) is one of the smaller sea turtles. It was listed as endangered in 1970 (35 FR 8491 8498, Jun 6, 1970) and was grandfathered into the ESA of 1973 (Harrington, 1982). It has overlapping plates that are thicker than those of other sea turtles. This protects them from being battered against sharp coral and

[92] Ocean convergence zone: "The quasi-horizontal flow of a fluid toward a common destination from different directions. When waters of different origins come together at a point or along a line (convergence line), the denser water from one side sinks under the lighter water from other side. The ocean convergence lines are the polar, subtropical, tropical, and equatorial" (USEPA, 2015p).

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, 2015n). Although in the Atlantic they range from the East Coast of the U.S. to northern Brazil, they are rarely found offshore of New England (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, 2015n).

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 Photo Credit: USFWS

Leatherback Sea Turtle. The leatherback sea turtle (*Dermochelys coriacea*) is the largest, most migratory, deepest-diving, and most wide-ranging sea turtle, found in all of the world's oceans. It was listed as endangered in 1970 (35 FR 8491 8498, June 6, 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, 2015m). Their diet consists of jellyfish and squid and while they may forage in coastal waters but they prefer open sea environments (USFWS, 2015m) (NOAA, 2015f). The numbers of leatherback sea turtles in the Caribbean and the Atlantic are stable (NOAA, 2015f).

Female leatherback sea turtles nest at 2 to 3 year intervals (USFWS, 2015m). They nest on high energy beaches composed of coarse sand that are adjacent to deep water and subject to erosion. In Maine they may be found along the Gulf of Maine coastline (USFWS, 2015m).

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).

Fish

One endangered fish species is federally listed for Maine as summarized in Table 6.1.6-7. Information on the habitat, distribution, and threats to the survival and recovery of each of this species in Maine is provided below.

Table 6.1.6-7: Federally Listed Fish Species of Maine

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Atlantic Salmon	*Salmo salar*	E	Yes	All perennial rivers, streams, estuaries, and Lakes connected to the Gulf of Maine

[a] E = Endangered, T = Threatened
Source: (USFWS, 2015o) (USFWS, 2015p) (NOAA, 2016b)

Atlantic Salmon. The Atlantic salmon (*Salmo salar*) was first listed as an endangered species in 1970 (74 FR 29344 29387, June 19, 2009) and has critical habitat designated in a distinct population segment (DPS) in the Gulf of Maine. This species is an anadromous fish, meaning it spends most of its life in brackish or salt water and migrates into freshwater to spawn. Their spawning habitat is characterized as being free-flowing medium gradient, cool in-water temperature and suitable gravel substrate. Atlantic salmon spend two to three years in freshwater environment, leave the rivers for the seas of Newfoundland and Labrador, returning to spawn one to three years later. Salmon leaving Maine are up to seven inches in length and when they return up to three years later they may be 36 inches and weigh up to 15 pounds (USFWS, 2005).

Eight rivers in the DPS support the Atlantic salmon populations as following: Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, Sheepscot Rivers, and Cove Brook (USFWS, 2005). Their numbers declined because dams and culverts block access to their spawning areas, other threats include predation and competition from non-native fish, degraded water quality, and pollution (NOAA, 2016b).

Plants

One endangered and two threatened plants are federally listed for Maine as summarized in Table 6.1.6-8. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Maine is provided below.

Table 6.1.6-8: Federally Listed Plant Species of Maine

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Eastern Prairie Orchid	*Platanthera leucophaea*	T	No	The Crystal Bog of northern Maine
Furbish Lousewort	*Pedicularis furbishiae*	E	No	The southern shore of the Saint John River in northern Maine
Small Whorled Pogonia	*Isotria medeoloides*	T	No	Understories of hardwood forests in southern Maine

[a] E = Endangered, T = Threatened, C= Candidate
Sources: (USFWS, 2012a) (USFWS, 2012b) (USFWS, 2016)

Eastern Prairie Orchid. The eastern prairie orchid (*Platanthera leucophaea*), also known as the eastern prairie fringed orchid, is a perennial herb which grows from an underground tuber and flowers in late June to early July for between 7 to 10 days. Blossoms often rise just above the height of the surrounding grasses and sedges and is pollinated by the hawk moth *(Lepidoptera sphingidae)*. It measures between 8 and 40 inches and has an upright leafy stem with a flower cluster. Generally, three to eight inch leaves surround the stem and the flower cluster is composed of 5 to 40 white flowers. Seed capsules mature over the growing season and are dispersed by the wind from late August through September. Plants may only flower once every few years. The species was federally listed as threatened in 1989 (54FR 39857 39863, Sep 28, 1989) and is one of Maine's rarest plants with fewer than 20 plants found each year. (USFWS, 2012a)

Eastern prairie orchid
Photo Credit: USFWS

Throughout its range, the Eastern prairie orchid occurs in a wide variety of habitats, from prairie to wetlands. It requires full sun and a grassy habitat with little or no woody encroachment. A symbiotic relationship between the seed and soil fungi, called mycorrhizae, is necessary for seedlings to become established. This fungi helps the seeds assimilate nutrients in the soil. (USFWS, 2012a)

Its habitat in Maine is limited to the Crystal Bog in northern Maine which characterized as a sphagnum-dominated fen fringed by white cedar and tamarack. Neighboring plants are sedges (Sedges), bog birch (*Betula pumila*), shrubby cinquefoil (*Dasiphora fruticose*), bog laurel (*Kalmia polifolia*), sheep laurel (*Kalmia angustifolia*) and other sphagnum bog plants. The next closest populations are located in Virginia and Michigan. Threats in Maine include altered hydrology of the bog, invasive plant species, succession to woody vegetation, and foot traffic. (USFWS, 2012a)

Furbish Lousewort. The Furbish lousewort (*Pedicularis furbishiae*) is a perennial member of the snapdragon family. Its distinctive, fern-like hairy leaves grow in a basal rosette and up the stem. In late July and August, reproductive plants send up a flowering spike up to 40 inches tall, with a cluster of tubular, yellow flowers one inch long and is pollinated by the common bumblebee (USFWS, 2012b).

The Furbish lousewort is endemic to the St. John River valley, and its entire range is limited to 140 miles of the St. John River, along the border of Maine and New Brunswick, Canada. The largest populations occur upstream from the confluence with the Allagash River. Populations downstream of Fort Kent are small and widely separated. It grows on a narrow strip of sloped riverbank which is damp, yet not too close to the river and close enough to the forest to benefit from the shade. It occurs almost exclusively on the south bank of the St. John. It was federally listed as endangered in 1978 (43 FR 17910 17916, May 27, 1978) (USFWS, 2012b).

Threats for the Furbish lousewort include: increasing flood and ice frequency, development and associated deforestation along the river, increased pollution, bank erosion, increased recreational use, introduction of invasive species, and possible decline of native bee pollinators (USFWS, 2012b).

Small Whorled Pogonia. The small whorled pogonia (*Isotria medeoloides*) 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 39831, Sep 9, 1982) and in 1994 was reclassified as threatened (59 FR 50852 50857) (USFWS, 2016). It is a rare and localized spreading plant, found in dry, open oak forests to wet woods (USFWS, 2016). It occurs in older hardwood stands that include beech, birch, maple, oak, hemlock, and hickory that have an open understory[93], preferring acidic soils along small streams that have a thick layer of litter (USFWS, 2016). In Maine, specific habitat may be found in Cumberland, Kennebec, Oxford, and York counties (USFWS, 2015q). Threats to small whorled pogonia include habitat loss due to urban expansion and forestry practices (USFWS, 2016).

6.1.7 Land Use, Recreation, and Airspace

6.1.7.1 Definition of the Resources

The following summarizes major land uses, recreational venues, and airspace considerations in Maine, 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, 2012b).

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

[93] Understory: "The layer of forest located underneath the canopy. Here, smaller trees and shrubs grow, replacing older trees as they die" (USEPA, 2015m).

Airspace

Airspace is generally defined as the space lying above the earth, above a certain area of land or water, or above a nation and the territories that it controls, including territorial waters (Merriam Webster Dictionary, 2015a). Airspace is a finite resource that can be defined vertically and horizontally, as well as temporally, when discussing it in relation to aircraft activities. Airspace management addresses how and in what airspace aircraft fly. Air flight safety considers aircraft flight risks, such as aircraft mishaps and bird/animal-aircraft strikes. The 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 consists of Service Units (organizations) that support the operational requirements.

The FAA Air Traffic Services Unit (the Unit) manages the National Airspace System (NAS) and international airspace assigned to U.S. control and is responsible for ensuring efficient use, security, and safety of the nation's airspace. FAA field and regional offices (e.g., Aircraft Certification Offices, Airports Regional Offices, Flight Standards District Offices [FSDOs], Regional Offices & Aeronautical Center, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (FAA, 2015c). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

6.1.7.2 Specific Regulatory Considerations

Appendix C summarizes numerous federal laws and regulations that, to one degree or another, affect land use in Maine. However, most site-specific land use controls and requirements are governed by local county, city, and village laws and regulations. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities. Table 6.1.7-1 summarizes the Maine laws relevant to land use and recreation. Because the nation's airspace is governed by Federal laws, there are no specific Maine state laws that would alter the existing conditions relating to airspace for this Draft PEIS.

Table 6.1.7-1: Relevant Maine Land Use, Recreation, and Airspace Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Public Law, 119th Second Session, Chapter 592: Ecological Reserve System	Maine DACF	"…to maintain one or more natural community types or native ecosystem types in a natural condition and range of variation and contribute to the protection of Maine's biological diversity, …as a benchmark against which biological and environmental change may be measured, as a site for ongoing scientific research, long-term environmental monitoring and education, and …to protect sufficient habitat for those species whose habitat needs are unlikely to be met on lands managed for other purposes."

6.1.7.3 Land Use and Ownership

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

Land Use

Forest and woodlands is the largest portion of land use with 66 percent of Maine's total land area occupied by this category (Table 6.1.7-2 and Figure 6.1.7-1). Shrub and grassland is the second largest area of land use with seven percent of the total land area. Agricultural land accounts for four percent of land use while developed areas account for approximately three percent of the total land area. The remaining percentage of land includes public land and other land covers that are not associated with specific land uses. (USGS, 2012c)

Table 6.1.7-2: Major Land Use in Maine

Land Use	Square Miles	Percent of Land
Forest and Woodland	19,813	64%
Shrub and Grassland	2,160	7%
Agricultural Land	1,142	4%
Developed Land	988	3%
Surface Water	6,172	20%

Source: (USGS, 2012c)

Forest and Woodland

Forest and woodland areas can be found throughout the state, many of them interspersed with, and adjacent to, agricultural areas. Mixed forest of conifer and deciduous trees are the predominant land cover. Most (95 percent) forest and woodland areas throughout Maine are privately owned (Maine DACF, 2010). Among all states east of the Mississippi River, Maine has the largest contiguous block of undeveloped forest. A number of forest products are produced by Maine's forests including timber, paper production, maple syrup, Christmas wreathes, and veneer. Maine's forests support 6,000 lakes and ponds and 32,000 miles of rivers and streams. Free public access to forestlands is set forth in Maine common law. Along with other northeastern states, Maine has a strong forest tourism economy, with many tourists drawn to the changing of leaves during the autumn months (Maine DACF, 2010). Section 6.1.6.3, Terrestrial Vegetation, presents additional information about terrestrial vegetation.

Ecological Reserve System

Maine ecological reserve system lands are comprised of 17 public land units totaling more than 90,000 acres, with individual units ranging in size from 775 acres to over 11,000 acres (Figure 6.1.7-1) (Maine DACF, 2013b). These reserves are managed by the Bureau of Parks and Public Lands and are set aside to protect natural forest and woodland ecosystems.

Private Forest and Woodland

Approximately 95 percent of Maine's total forestland is privately owned (Maine DACF, 2010). Private forestlands provide a large public benefit, including forest products, wildlife habitat, jobs, scenic beauty, and outdoor recreation opportunities. These lands are scattered throughout the state. For additional information regarding forest and woodland areas, see Section 6.1.6, Biological Resources and Section 6.1.8, Visual Resources.

Shrub and Grassland

With seven percent of Maine’s surface area comprised of shrub and grassland, there are many locations throughout the state where this land use occurs. A large portion of the southern half of the sate contains grassland barrens known as the Sandplain Grassland (Maine DACF, 2013c). The Sandplain Grassland communities are used for preservation and conservation purposes. However, there are many areas where development has occurred and where fire has been suppressed, allowing the grasslands to transition to other types of vegetation. For additional information on shrub and grassland, see Section 6.1.6, Biological Resources.

Agricultural Land

Agricultural land exists in every region of the state (Figure 6.1.7-1). Over four percent of Maine's total land area is classified as agricultural land. In 2012, there were 8,173 farms in Maine and most were owned and operated by small, family businesses, with the average farm size of less than 200 acres (USDA, 2012). Some of the state's largest agricultural uses include blueberries (largest producer in the world), maple syrup, (second in the nation), potatoes, and other fruits and vegetables. Other agricultural uses include livestock for dairy and meat, goats, sheep, and hogs (Maine DACF, 2013d). For more information by county, access the USDA Census of Agriculture website:
http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Maine/.

Developed Land

Developed land in Maine tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 6.1.7-1). Although only three percent of Maine land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 6.1.7-3 lists the top five developed metropolitan areas within the state and their associated population estimates, and Figure 6.1.7-1 shows where these areas are located within the developed land use category.

Table 6.1.7-3: Top Five Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Bangor Metro Area	203,914
Portland-South Portland Metro Area	61,210
Lewiston-Auburn Metro Area	59,397
Augusta-Waterville Micro Area	29,159
Knox County	25,689
Total Population of Metropolitan Areas	379,369
Total State Population	1,330,089

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

Land Ownership

Land ownership within Maine has been classified into four main categories: private, federal, state, and tribal (Figure 6.1.7-2).

Private Land

The majority of land in Maine is privately owned, with most of this land falling under the land use categories of agricultural, forest and woodland, and developed. Highly developed, urban, metropolitan areas transition into suburban, agriculture, shrub, and woodland areas, which then transition into more wild and remote areas. Private land exists in all regions of the state. [94]

Federal Land

The federal government manages 286.6 square miles of Maine land with a variety of land types and uses, including national parks, monuments, historic sites, military bases, wildlife refuges, and national forests (Figure 6.1.7-2) (USGS, 2012d) (USGS, 2014d). Four federal agencies manage federal lands throughout the state (Table 6.1.7-4).

Table 6.1.7-4: Federal Land in Maine

Agency	Square Miles	Representative Type
Department of Defense	62.0	Military Bases, Training Areas
U.S. Fish and Wildlife Service	98.5	Wildlife Refuges
USDA Forest Service	60.3	National Forest
National Park Service	65.8	Parks, Monuments, Historic Sites

Sources: (USGS, 2012d) (USGS, 2014d)

- The Department of Defense owns and manages 62 square miles used for military bases and military training centers.
- The U.S. Fish and Wildlife Service (USFWS) owns and manages 98.5 square miles consisting of National Wildlife Refuges in Maine.

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

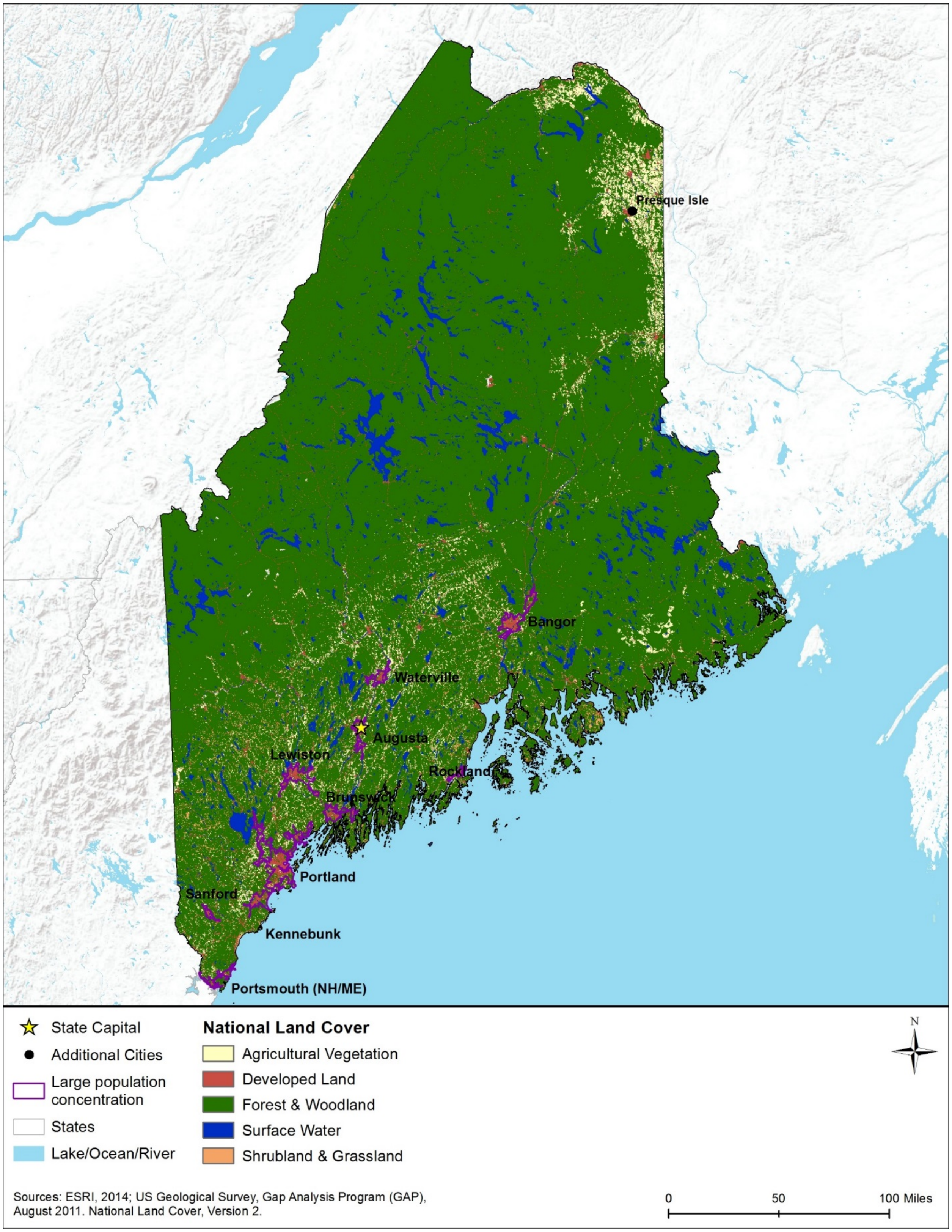


Figure 6.1.7-1: Land Use Distribution

- The USFWS has protected over 1.67 million acres of wetlands, coastal, rivers for wild Atlantic salmon, and island habitat for nesting seabirds in coordination with other federal, state, and local agencies; private landowners; and non-government organizations. Some lands were acquired by the Maine Coastal Heritage Trust (MCHT) and are now managed by the USFWS (USFWS, 2006).
- The United States Department of Agriculture (USDA) Forest Service owns and manages 60.3 square miles set aside as the White Mountain National Forest.
- The National Park Service manages 65.8 square miles within the Acadia National Park and other sites.

State Land

The Maine government owns approximately 875 square miles of land comprised of forests and woodlands, historic sites, state offices, state parks, and recreation areas. One main state agency, the Maine DACF manages 99 percent of state lands.

- There are 11 State Historic Sites throughout Maine; most are historic forts.
- There are 36 locations of public reserved lands ranging from 500 acres to 42,800 acres for a total of more than 600,000 acres throughout the state. These multi-use lands are open to the public for recreational activities but are not managed or staffed like state parks, allowing for a more wild, and remote experience. (Maine DACF, 2015a)
- The MCHT protects over 138,000 acres, including 300 coastal islands, and hundreds of miles of shoreline in partnership with other federal, state, and local agencies; private landowners; and non-government organizations (MCHT, 2015).
- Ecological reserves are protected areas for conservation and study and research of ecology, wildlife, and other natural resources. There are 17 areas covering more than 90,000 acres throughout the state (Maine DACF, 2013b).
- State parks contain natural, historic, cultural, and/or recreational resources of significance to Maine residents and visitors. There are 36 state parks throughout Maine (Figure 6.1.7-3).

Tribal Land

The Bureau of Indian Affairs, along with individual tribes, manages 65 square miles of land currently located in the state. These lands are composed of two Indian Reservations (Figure 6.1.7-2 and Table 6.1.7-5). For additional information regarding tribal land, see Section 6.1.11, Cultural Resources.[95]

Table 6.1.7-5: Indian Reservations of Maine

Reservation Name	Square Miles
Passamaquoddy Reservation	43
Penobscot Reservation	22

Sources: (USGS, 2012d)

[95] As noted in Section 6.1.11, Cultural Resources, there are four federally recognized Native American tribes located in Maine. However, only two of the Native American tribes manage reservations (NPS, 2016b).

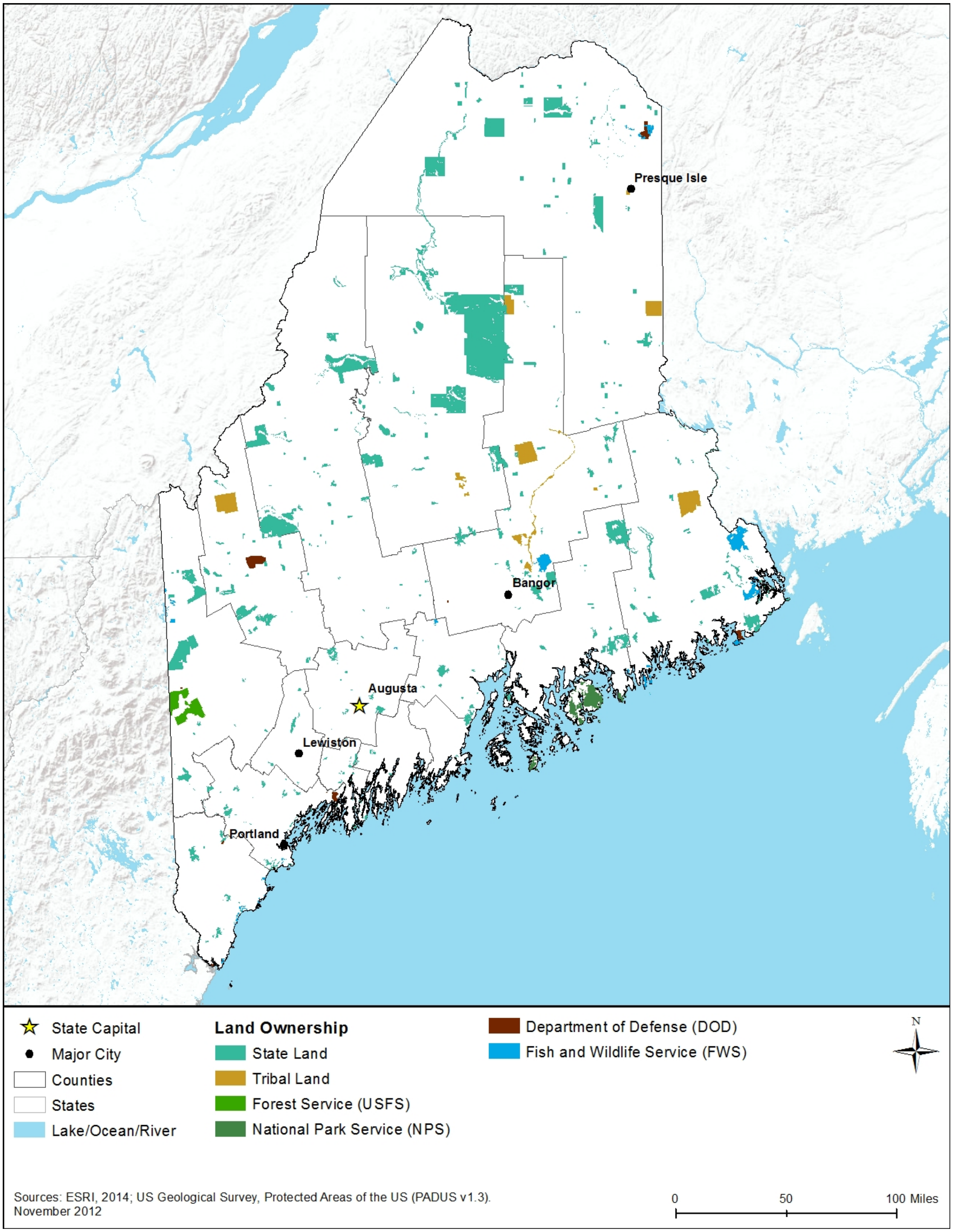


Figure 6.1.7-2: Land Ownership Distribution

6.1.7.4 Recreation

Maine is relatively small in size, with a rocky coastline on the Atlantic Ocean and a densely forested interior. The state is not densely populated, with large areas completely unpopulated. 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 Maine. For information on visual resources, see Section 6.1.8, Visual Resources, and for information on the historical significance of locations, see Section 6.1.11, Cultural Resources.

Northern Region

The Appalachian Mountains make up the western portion of Maine's Northern Region, flowing into the densely forested interior of the state. This region has locations known for their scenic beauty and are often visited by avid outdoorsmen and others seeking solitude. Mountain lakes and streams make this region an ideal location for fishing and other water-related activities.

The Allagash Wilderness Waterway is 92-miles of lakes, ponds, rivers, and streams centered in the commercial forests of northern Maine, and is a Wild and Scenic River. It is known for its scenic vistas, and is a popular location for camping, canoeing, fishing, hunting, snowmobiling, and watching wildlife (Maine DACF, 2013e).

Baxter State Park is over 300 square miles of wilderness and public forest and includes Mount Katahdin, the highest point in Maine and the beginning of the Appalachian Trail. The park is popular for wilderness camping; cabins, tent campsites, and lean-tos are located throughout the park. Licensed hunting and trapping is available within designated areas, and pond and stream fishing has become the primary reason for visiting Baxter State Park. Canoes, kayaks, and motorized boats are permitted in most streams and ponds. In the winter, above the tree line downhill skiing, snowboarding, mountain hiking, and climbing are allowed; below the tree line camping, snowshoeing, and cross-country skiing are allowed (Baxter State Park Authority, 2012).

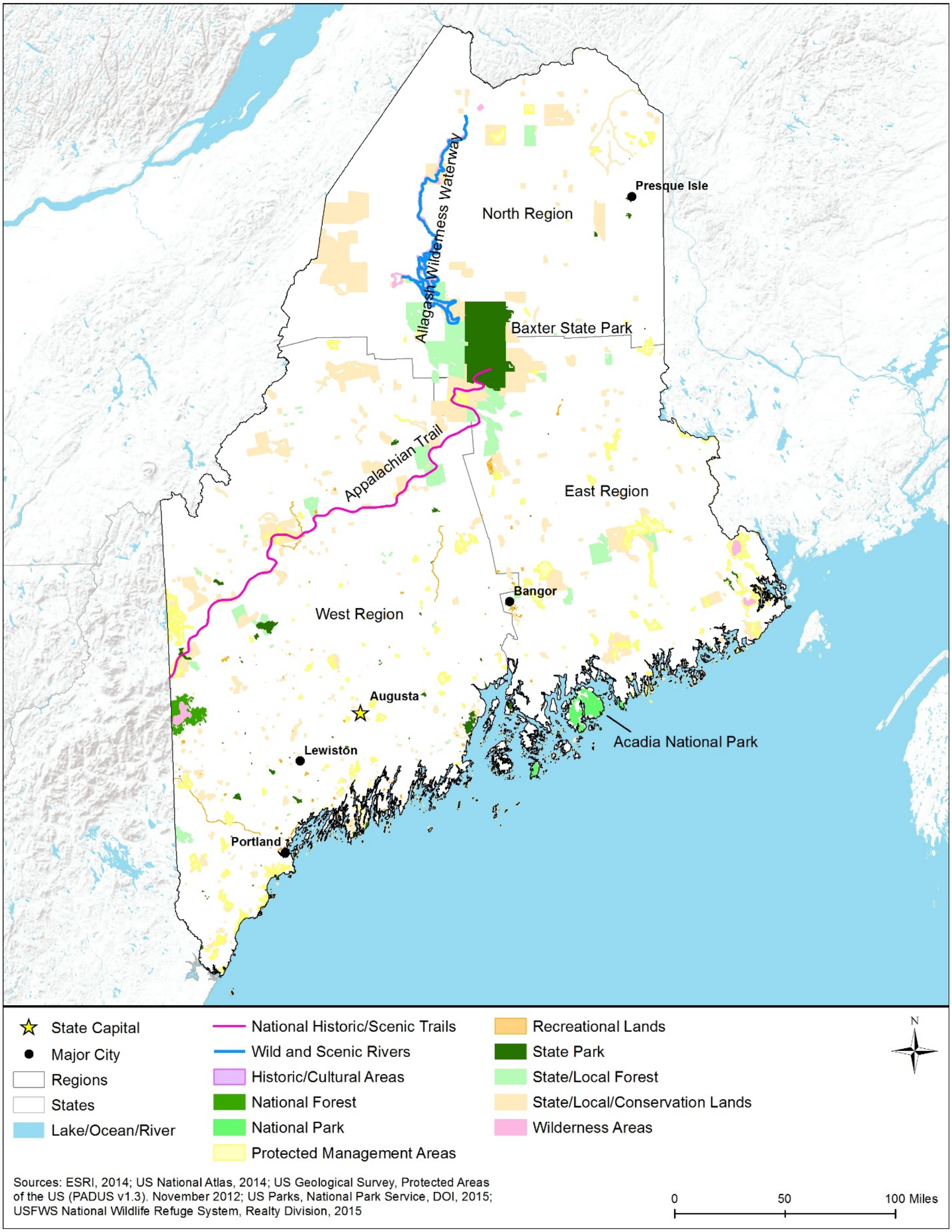


Figure 6.1.7-3: Maine Recreation Resources

Western Region

Maine's Western Region is bordered by Vermont and Canada, with the Appalachian Mountains on the west and the Gulf of Maine with many bays and inlets on the east. The region is notable for its many hiking trails, valleys containing lakes, and mountain streams.

Hiking and recreational trails are popular recreational venues in Maine. Although the Appalachian Trail begins in the Northern Region, it continues across the Western region into Vermont; the 281 miles of trail in Maine cover difficult terrain and is not recommended for novice hikers (The Appalachian Trail Conservancy, 2015). The Kennebec Valley Trail is eight miles of recreational trail located along the Kennebec River, with year-round use including all-terrain vehicles (ATVs), cross-country skiing, dog sledding, horseback riding, and bicycling (Maine DACF, 2013f). The Four Seasons Adventure Trail is 29-miles of gravel trail that follows along lake, bog, and river for ATVs, cross-country skiing, dog sledding, horseback riding, snowmobiling, snowshoeing, and hiking (Maine DACF, 2013g).

Eastern Region

The Eastern Region extends into the Gulf of Maine, and contains the northernmost coastline with its craggy shore and small islands. The region contains Maine's most populous city, Bangor, which is known for its wildlife and scenery, and is a popular location for outdoor activities including boating and hiking.

Acadia National Park is located on Maine's rugged coast, known for granite peaks, including the highest peak on the Atlantic coast. The park contains carriage roads with crushed rock for bicyclists, fixed anchors and rappel stations for rock climbers, and hiking trails with historic significance. The park is also popular for horseback riding, geocaching,[96] leaf peeping, and picnicking. In addition to the coastal docks and piers, the park contains ponds and lakes with access for motorized and non-motorized boats; swimming access; and licensed saltwater, ice, and lake and pond fishing. In the winter, the park is known for cross-country skiing, snowshoeing, snowmobiling, and dog sledding (NPS, 2015a).

Roque Bluffs State Park is almost 0.5-square miles of coastal area separated from a freshwater lake by picnic areas and a playground; boating, swimming, fishing, cross-country skiing, snowshoeing, hiking, and birdwatching are available (Maine DACF, 2013h). Grand Lake Stream is a village of camps and lodges known for ecotourism, centered on a lake beach with swimming, boating, and other family activities. Grand Lake Stream is notable for having the highest concentration of guides for year-round hunting and fishing excursions within the state (Grand Lake Stream Area Chamber of Commerce, 2012).

6.1.7.5 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

[96] Geocaching: Outdoor hiking/recreational activity involving GPS coordinates to find a hidden container referred to as geocaches.

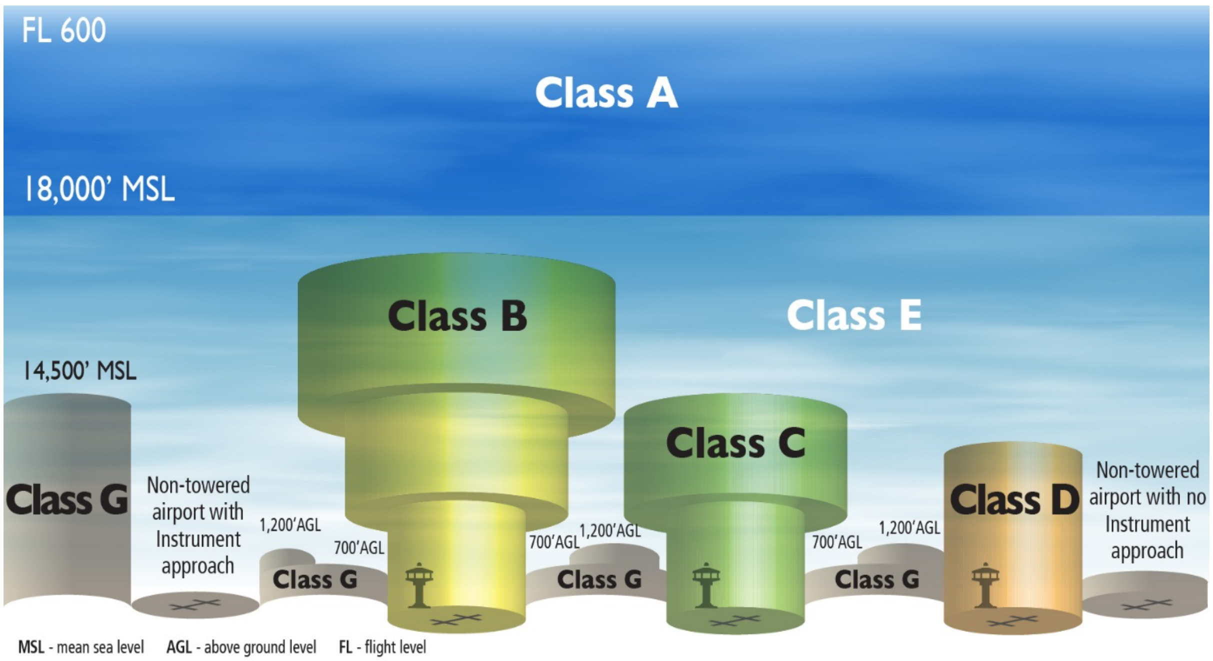
flight rules and regulations, airspace management actions, and air traffic control procedures) to ensure the safety of aircraft and protection of the public.

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 6.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[97] service is based on the airspace classification." (FAA, 2008).



Source: Derived from (FAA, 2008)

Figure 6.1.7-4: National Air Space Classification Profile

[97] ATC: Approved authority service to provide safe, orderly and expeditious flow of air traffic operations (FAA, 2015d).

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[98]. 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).[99]
- **Class B:** Airspace from the surface up to 10,000 feet MSL near the busiest airports with heavy traffic operations. The airspace is tailored to the specific airport in several layers. An ATC clearance is required for all aircraft to operate in this area.
- **Class C:** Airspace from the surface to 4,000 feet above the airport elevation surrounding the airport. Applies to airports with an operational control tower, serviced by a radar approach control, and certain number of IFR operations or total number of passengers boarding aircrafts. Airspace is tailored in layers, but usually extends out to 10 NM from 1,200 feet to 4,000 feet above the airport elevation. Entering Class C airspace requires radio contact with the controlling ATC authority, and an ATC clearance is ultimately required for landing.
- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.
- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2008).

Uncontrolled Airspace

Class G: No specific definition. Refers generally to airspace not designated as Class A, B, C, D, or E. Class G airspace is from the surface to the base of Class E airspace.

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (See Table 6.1.7-6.

Other Airspace Areas

Other airspace areas, explained in Table 6.1.7-7 include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

[98] MSL: The average level of for the surface of the ocean; “The height of the surface of the sea midway between the average high and low tides” (Merriam Webster Dictionary, 2015b).
[99] IFR: Rules for the conduct of flights under instrument meteorological conditions (FAA, 2015d).

Table 6.1.7-6: SUA Designations

SUA Type	Definition
Prohibited Areas	"Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts."
Restricted Areas	"Airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute 14 CFR Part 73."
Warning Areas	"Airspace of defined dimensions, extending from three NM from the 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)

Table 6.1.7-7: 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.

Source: (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 aboveground level
- Any construction or alteration:
  - Within 20,000 ft of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft
  - Within 10,000 ft of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 ft
  - Within 5,000 ft of a public use heliport which exceeds a 25:1 surface
- Any highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards
- When requested by the FAA
- 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.

Maine Airspace

Maine Department of Transportation (MaineDOT) handles aviation-related planning and program activities within Maine. MaineDOT also furthers the implementation of FAA requirements specific to Maine. There is one FAA FSDO for Maine – Portland (FAA, 2015c).

Maine airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP documents the strategic plan for maintaining and improving the state's public airports system to support aviation needs, as well as addressing key issues associated with their airports (National Association of State Aviation Officials (NASAO), 2015). Figure 6.1.7-5 presents the different aviation airports/facilities located in Maine, while Figures Figure 6.1.7-6 and Figure 6.1.7-7 show the breakout by public and private. There are approximately 186 airports/facilities (public and private) within Maine as presented in Table 6.1.7-8 and Figure 6.1.7-5 through Figure 6.1.7-7 (U.S. Department of Transportation, 2015b).

Table 6.1.7-8: Type and Number of Maine Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	50	65
Heliport	0	24
Seaplane	20	26
Ultralight	0	1
Balloonport	0	0
Gliderport	0	0
Total	70	116

Source: (U.S. Department of Transportation, 2015b)

There are Class C and E controlled airports for Maine as follows:

- Two Class C –
  - Bangor International
  - Portland International Jetport
- Three Class E –
  - Augusta State
  - Hancock Count-Bar Harbor
  - Houlton International

SUAs (i.e., one Prohibited, three MOAs, and three Warning (W) off the coast) located in Maine are as follows:

- Kennebunkport (Prohibited)
  - P67 – Surface to 1,000 feet MSL
- Bangor (MOA)
  - Deepwoods – Surface to 3,000 feet MSL
- Griffiss Air Force Base (MOA)
  - Condor 1 and 2 – 7,000 feet MSL to, but not including FL 180
- Casco Bay (W)
  - W103 – Surface to and including 2,000 feet MSL

- Machias (W)
  - W102H – From above 17,000 feet MSL to FL 600
  - W102L – Surface to and including 17,000 feet MSL (FAA, 2015f)

Figure 6.1.7-8 presents the SUAs in Maine. There are no TFRs for Maine (FAA, 2015f). Figure 6.1.7-9 depicts the MTRs for the state comprised of six Instrument Routes (800, 804, 805, 850, 851, and 852), and three Visual Routes (840, 841, and 842).

UAS Considerations

The National Park Service (NPS) signed a policy memorandum on June 19, 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 is one national park and other NPS managed areas within Maine that have to comply with this agency directive (NPS, 2015b).

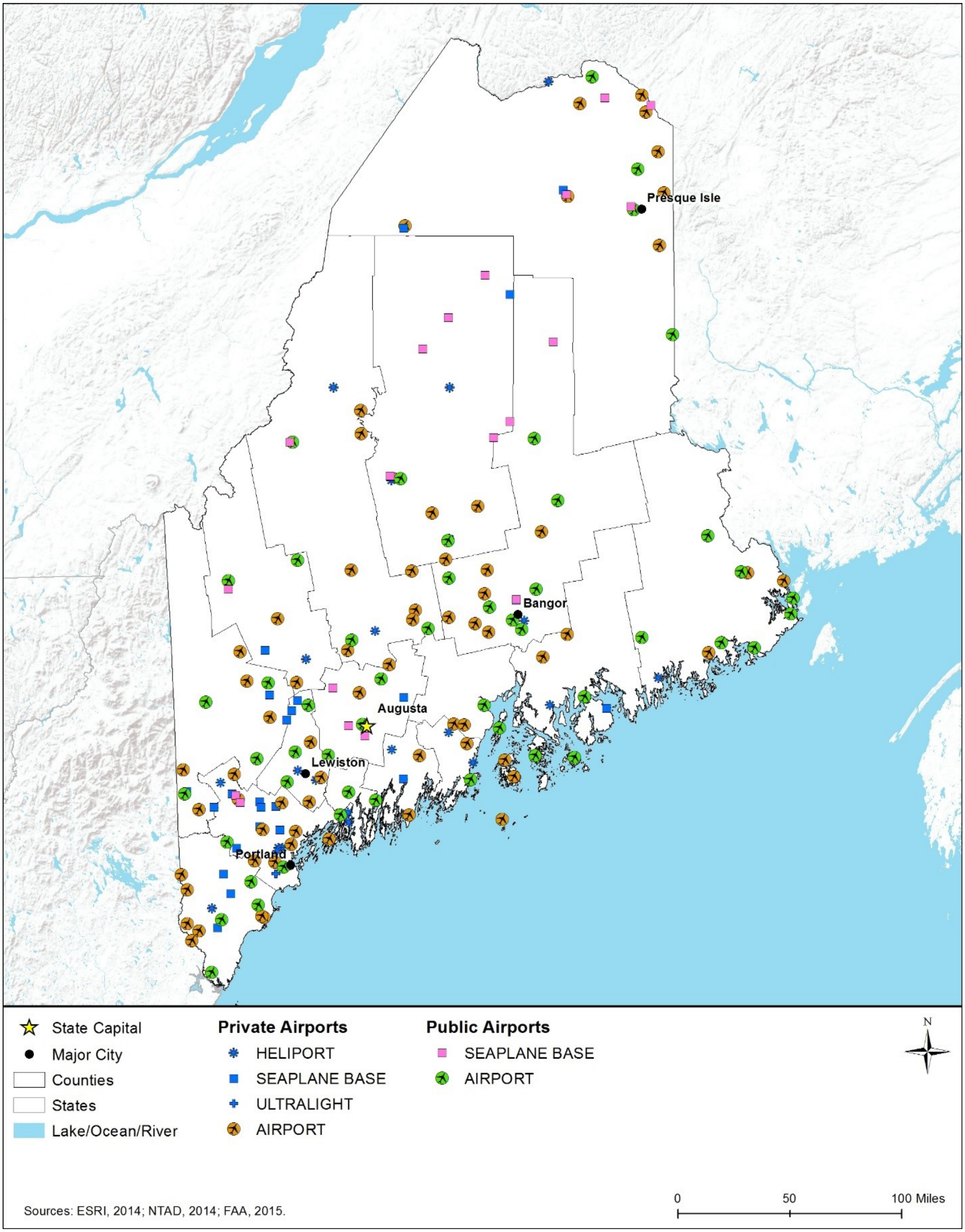


Figure 6.1.7-5: Composite of Maine Airports/Facilities

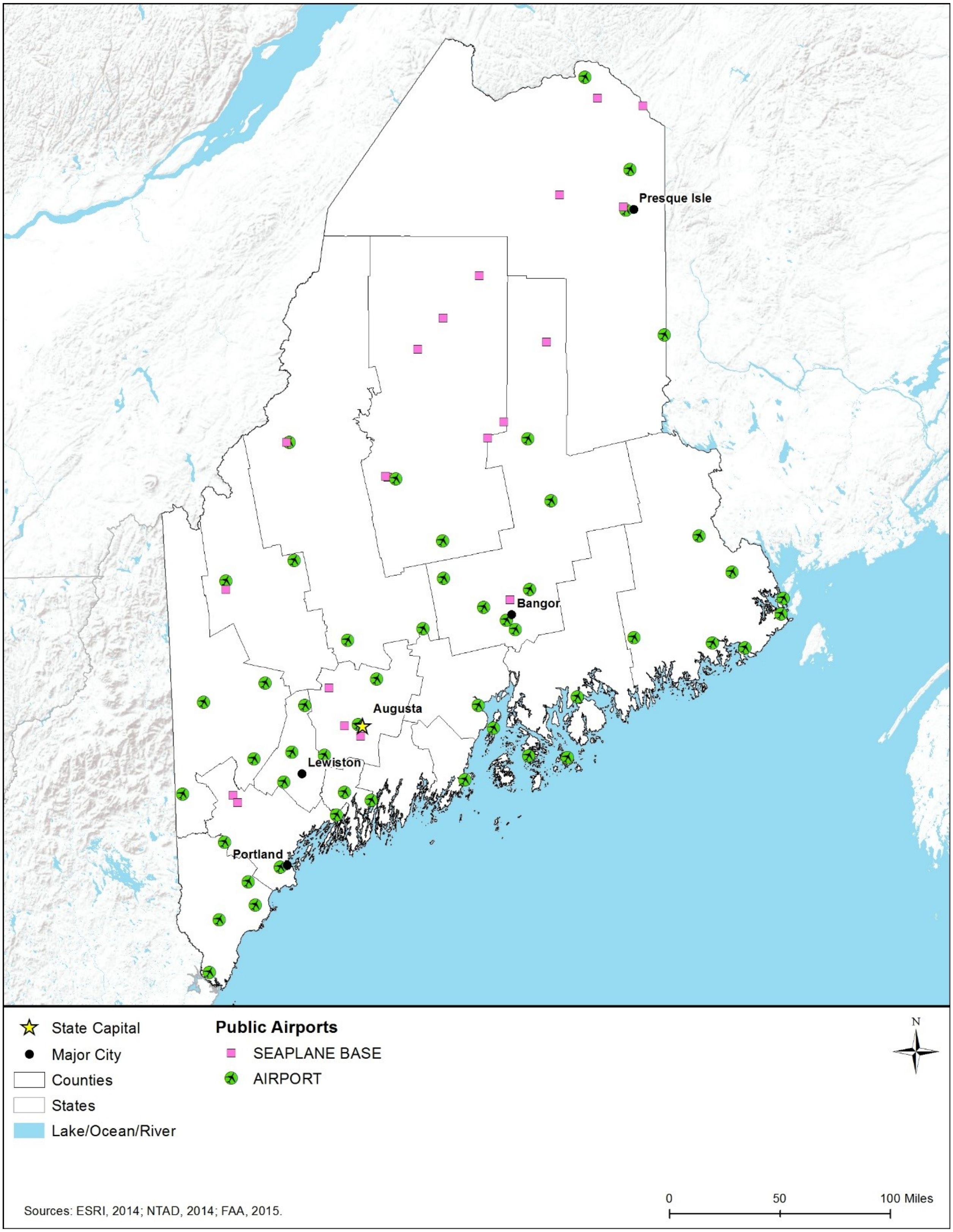


Figure 6.1.7-6: Public Maine Airports/Facilities

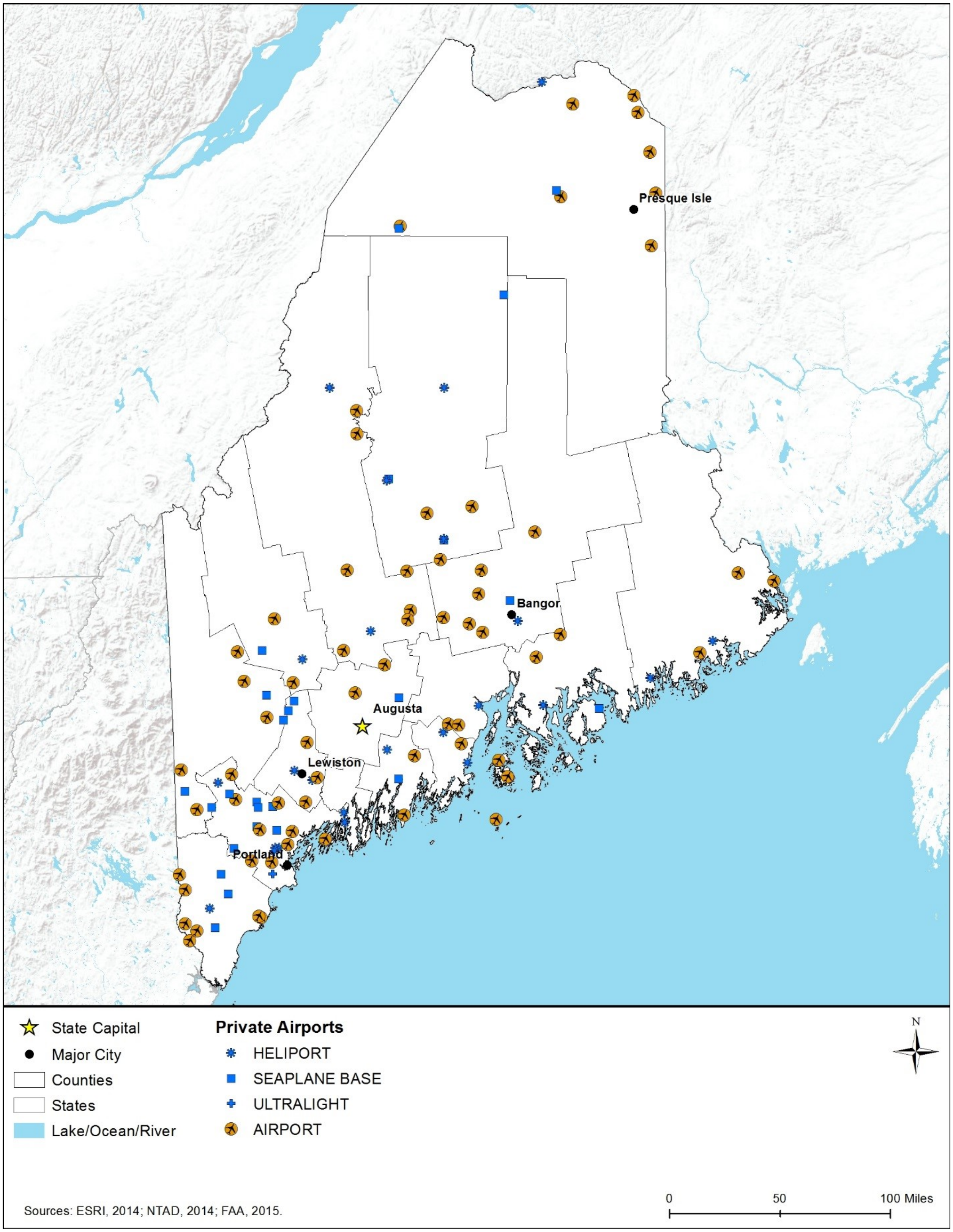


Figure 6.1.7-7: Private Maine State Airports/Facilities

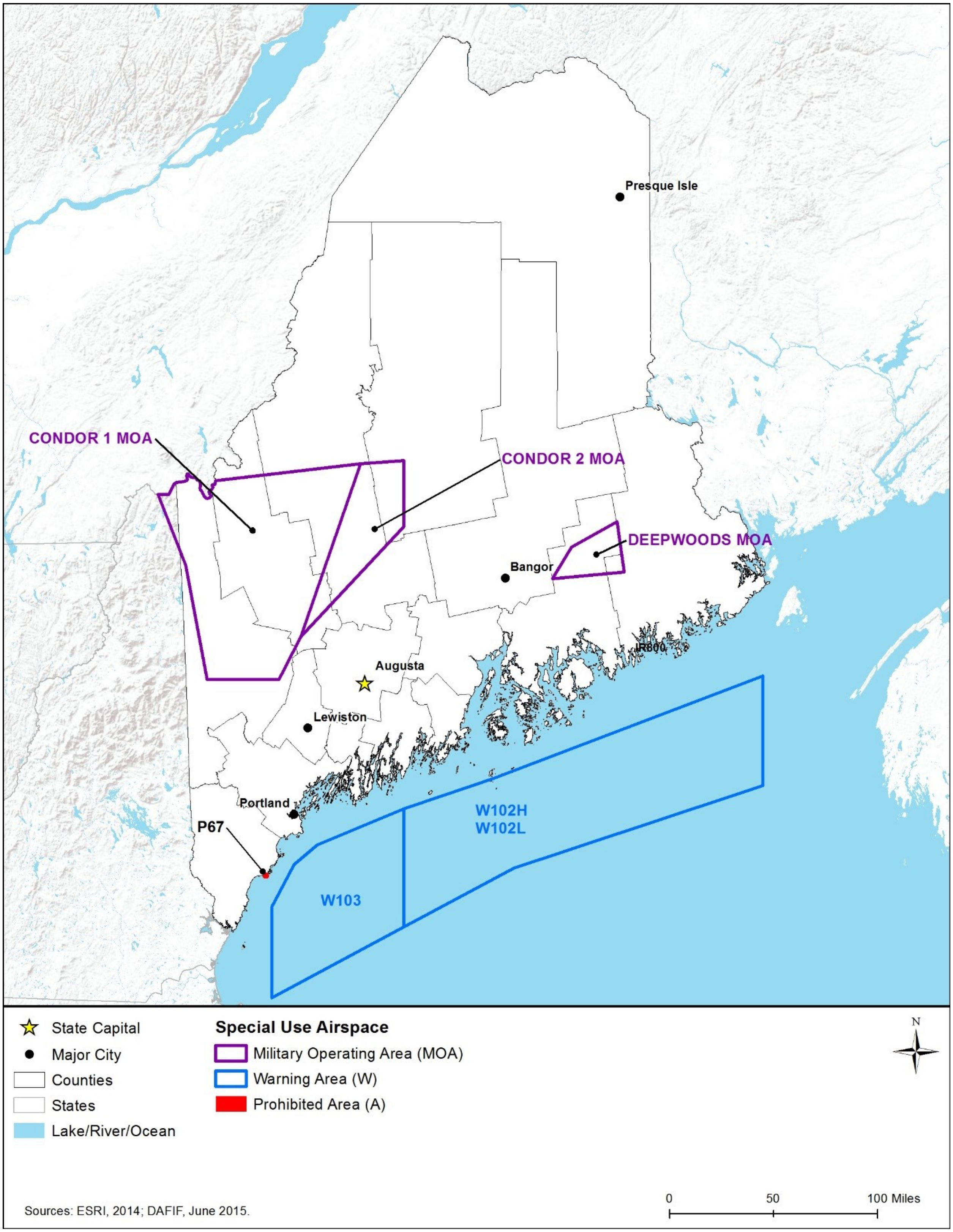


Figure 6.1.7-8: SUAs in Maine

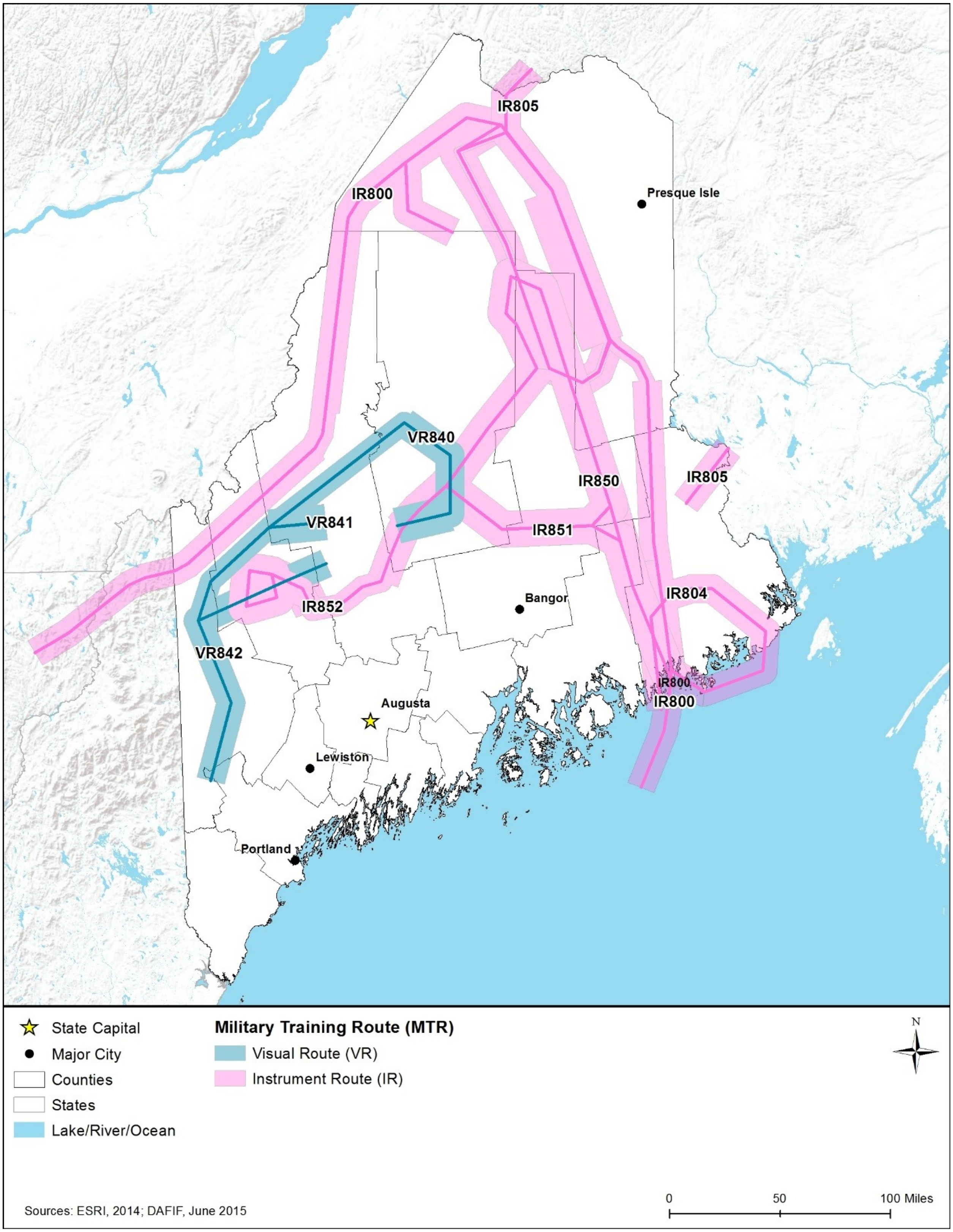


Figure 6.1.7-9: MTRs in Maine

6.1.8 Visual Resources

6.1.8.1 Definition of the Resource

Visual resources influence the human experience of a landscape. Various aspects combine to create visual resources, such as color, contrast, texture, line, and form. Features (e.g., mountain ranges, city skylines, ocean views, unique geological formations, or rivers) and constructed landmarks (e.g., bridges, memorials, cultural resources, or statues) are considered visual resources. For some, cityscapes are valued visual resources, whereas others prefer natural areas. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating Proposed Actions for NEPA and NHPA compliance. 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). In Maine, a scenic resource is described as “Public natural resources or public lands visited by the general public, in part for the use, observation, enjoyment, and appreciation of natural or cultural visual qualities. The attributes, characteristics, and features of the landscape of a scenic resource provide varying responses from, and varying degrees of benefits to, humans.” (Maine State Planning Office, 2008).

6.1.8.2 Specific Regulatory Considerations

This section presents state and local laws and regulations that relate to visual and scenic resources.

Table 6.1.8-1: Relevant Maine Visual Resource Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Coastal Policy Act of 1987	Maine DEP	“This act directed the State Planning Office to identify Heritage Coastal Areas, which are places where scenic, historic, and natural features are concentrated in a way that make them unique. They may deserve special attention because of their significance.”
Comprehensive Planning and Land Use Act of 1988	Maine DACF	Establishes that municipalities develop growth management programs through planning consistent with the Land Use Act and Coastal Policy Act.
Natural Resources Protection Act of 1988	Maine DEP	The Act, in part, states “…the state's rivers and streams, great ponds, fragile mountain areas, freshwater wetlands, significant wildlife habitat, coastal wetlands and coastal sand dune systems are resources of state significance. These resources have great scenic beauty and unique characteristics, unsurpassed recreational, cultural, historical and environmental value of present and future benefit to the citizens of the state…”

In addition to the state laws and regulations, local zoning laws may apply related to visual resources. Viewsheds and scenic vistas are increasingly important to the state’s towns, cities, and villages as they look at the future planning of their municipalities. Maine has implemented statewide performance standards to protect designated scenic views and scenic resources. The Comprehensive Planning and Land Use Act of 1988 was established to control and focus growth of communities and prevent the loss of character and to control urban sprawl. The *Guidelines for Maine's Growth Management Program* provided direction for communities to accomplish their planning, including direction for scenic resource inventory and analysis (Office of Comprehensive Planning, Maine Department of Economic and Community Development, 1988). Maine's Natural Resources Protection Act of 1988 requires that activities not "unreasonably interfere with existing scenic, aesthetic, recreational, or navigational uses" (Maine DEP, 2007b).

Maine continued to refine their planning processes, including the development of documents specific to visual resources. The 1990 *How to Conduct an Inventory of Scenic Areas* was supplemented by the 2005 revised planning document *Comprehensive Planning: A Manual for Maine Communities* suggests that each local planning committee identify and inventory the community's visual assets. "The following aspects are suggested as resources to be identified and evaluated:

- Natural or cultural features in the landscape that are visually attractive: for example, churches, lighthouses, fields, farmhouses, villages, mountains or hills, islands, marshes, old growth stands of trees, and shorelands. These areas may or may not be highly visible from public places.
- Views from public places of landscapes that people prefer: public places include roads, parks, trails, and other facilities belonging to the town, state, or federal agencies. Research has found that people prefer views of water and islands; managed land (such as farms, fields, and woodlands); traditional development (such as village landscapes, city skylines, working waterfronts, and lighthouses); and mountains and hills.
- Segments of the municipality with distinctive visual character or scenic quality: the town (or its major roads) can be divided into parts according to how visual characteristics vary. Some towns will have only "village" and "rural" areas. Others will be more complex, with different types of manmade landscapes on terrain that ranges from hills and ridgelines to coastal plains.
- State-identified scenic areas and Coastal Heritage Areas: scenic areas identified by the State Planning Office should be noted for their high quality. (Maine State Planning Office, 2005)

An additional planning document was prepared to support communities in preparing scenic inventories, *Protecting Local Scenic Resources—Community Based Performance Standards* (Maine State Planning Office, 2007). This document provides a visual resource inventory methodology based on the Bureau of Land Management's Manual 8410 to use as an option to the suggested inventory method within Maine's 2005 Planning Manual (Maine State Planning Office, 2007). The 2008 *Scenic Assessment Handbook* was prepared help guide the scenic inventory and identification process within coastal and wetland areas in addition to identifying and inventorying viewpoints when complying with Title 35-A MRSA* Ch. 34-A (Wind Power Law) (Maine State Planning Office, 2008).

While the 2005 planning manual recommends that municipalities conduct visual resource inventories during their planning process to support future land use decisions, some towns may not have inventories prepared. As of 2007, of the 433 towns in Maine, 287 had plans that were consistent with the 1988 Comprehensive Planning Act and have been evaluated every four years to maintain consistency with the Act (Cullingworth & Caves, 2014).

6.1.8.3 Character and Visual Quality of the Existing Landscape

Maine's landscape is predominantly forested, approximately 90 percent of the state is covered in forest, the most of any state in the United States (USFS, 2005). The southern portion of the state borders the Atlantic coastline and the state includes the Appalachian Mountains continuing from the south in New Hampshire and the Longfellow Mountains (MDIFW, 2005).

The visual resources of the state include coniferous and deciduous forest, thousands of lakes and wetland areas, and picturesque coastline with beaches, cliffs, and coastal islands (MDIFW, 2005). Classic New England fishing villages and quaint oceanside towns are highly valued scenic areas for tourists and locals, with both natural visual surroundings as well as regional architectural features. Overall, Maine is a state rich in visual resources.

Maine has considered the management and protection of scenic resources in many of their land use and planning policies. Those policies allow for consideration and protection of visual resources in project placement and development. The areas listed below have additional management, significance, or protection through state or federal policy, as well as being identified as visually significant areas.

6.1.8.4 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 6.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Maine, there are 1,594 NRHP listed sites, which include 45 National Historic Landmarks and 1 International Historical Site (NPS, 2014a). 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 Landscape.* The standards and guidelines "require retention of the greatest amount of historic fabric, including the landscape's historic form, features, and details as they have evolved over time," which directly protects the historic properties and the visual resources therein (Weeks, 1995).

National Historic Landmarks (NHLs)

NHLs 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, 2015c). Generally, NHLs are comprised of historic buildings such as residences, churches, civic buildings, and institutional buildings. Other types of historic properties include battlefields and canals. The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities that may be considered visual resources or visually sensitive at these sites. There are 44 NHLs in Maine; the majority are historic homes and buildings, but others are schooners, forts, and archaeological sites or districts. The scenic and visual resources of these landmarks and surrounding areas are managed for consistency with the historic resource and aesthetics of the landscape (NPS, 2015d).

National Historic Sites

Maine has the only International Historic Site in the U.S., Saint Croix Island, which has historic significance for the U.S., Canada, Native Americans, and France. The island itself is uninhabited and visitation is discouraged, allowing for protection of the scenic resources on the island. The mainland park offers views of the island, and the land within the park contains forested and historic areas. (NPS, 2015e)

The area known as Maine Acadian Culture within the St. John Valley in northern Maine is a historic and cultural area managed by the NPS in conjunction with state, local, and private agencies (Figure 6.1.8-2). Much of the area is rural farmland and undeveloped forest, making the valley a valuable scenic resource. (NPS, 2015f)

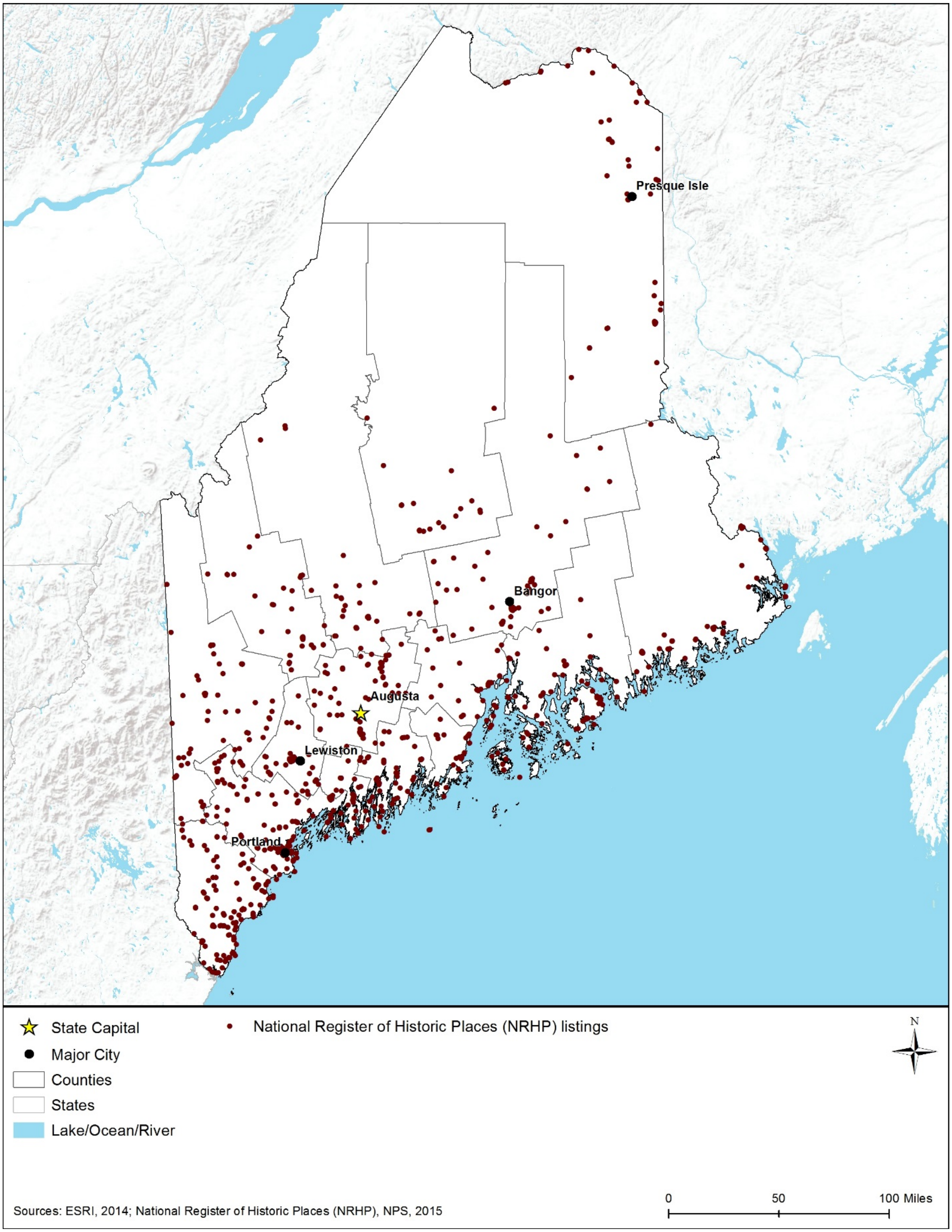


Figure 6.1.8-1: Cultural and Heritage Resources That May Be Visually Sensitive

Source: (NPS, 2015g)

Figure 6.1.8-2: St. John's Valley, Maine Acadian Culture

State Historic Sites

There are 11 State Historic Sites throughout Maine; most are historic forts. The sizes of the sites range from 0.75 acres up to 124 acres at Fort Knox (Table 6.1.8-2). The scenic resources are one aspect that makes these areas special and managed for consistency with the surrounding landscapes. (Maine DACF, 2014)

Table 6.1.8-2: Maine State Historic Sites

Historic Site	Acres	Location
Colonial Pemaquid (Ft. William Henry)	19	Bristol
Eagle Island	17	S. Harpswell
Fort Edgecomb	3	Edgecomb
Fort Halifax	0.75	Winslow
Fort Kent	3	Fort Kent
Fort Knox	124	Prospect
Fort McClary	27	Kittery Point
Fort O'Brien	2	Machiasport
Fort Popham	3	Phippsburg
Katahdin Iron Works	23	T6R9 WELS
Whaleback Shell Midden	11	Damariscotta

Source: (Maine DACF, 2014)

6.1.8.5 Parks and Recreation Areas

Parks and recreation areas include National Parks, state parks, national or state trails, and other protected areas used for recreational activities. Parks and recreation areas often contain scenic resources and are visited because of their associated visual or aesthetic qualities. Figure 6.1.7-3 in Section 6.1.7, Land Use, Recreation, and Airspace identifies parks and recreational resources that may be visually sensitive in Maine. For additional information about recreation areas, including national and state parks, see Section 6.1.7, Land Use, Recreation, and Airspace.

National and International Parks

The 47,000 acre Acadia National Park (Figure 6.1.8-3) consists of numerous islands, and 12,000 acres within the park are protected by NPS conservation easements. The park contains rocky shorelines, sandy beaches, and forested uplands; all valued scenic resources protected by the management of the National Park Service (NPS) (NPS, 2015h).

Source: (NPS, 2015i)

Figure 6.1.8-3: Acadia National Park

The 2,800 acre Roosevelt Campobello International Park is jointly managed by Canada and the NPS. This island park contains the historic summer home of Franklin D. Roosevelt, manicured gardens, as well as thousands of acres of natural areas containing forests, beaches, and ocean headlands. (Roosevelt Campobello International Park, 2015)

State Parks

The 36 state parks throughout Maine provide open space and scenic vistas both within towns and in natural areas away from civilization. Scenic resources within the parks include beaches, coastline, islands, rivers, lakes, ponds, scenic overlooks, woodlands, and forests (Maine DACF, 2014). These scenic areas may be protected from intrusions into vistas from structures or other infrastructure. Table 6.1.8-3 contains a sampling of state parks and their associated visual attributes. For a complete list of state parks, visit the Maine DACF website: http://www.maine.gov/dacf/parks/index.shtml.

Table 6.1.8-3: Examples of Maine State Parks and Associated Visual Attributes

State Park	Visual Attributes
Birch Point	Beach, forest vitas, views of Penobscot Bay
Mackworth Island	Views of Casco Bay and Portland, forest vistas, bird sanctuary
Two Lights	Rocky coast, lighthouses, ocean views

Source: (Maine DACF, 2015b)

Public Reserved Lands

There are 36 locations of public reserved lands ranging from 500 acres to 42,800 acres for a total of more than 600,000 acres throughout the state. These multi-use lands include scenic resources, and are open to the public for recreational activities but are not managed or staffed like state parks, allowing for a more wild, and remote experience. (Maine DACF, 2015a)

State and Federal Trails

In Maine, there are 25 interpretive Natural Heritage Hikes that provide information about the cultural, geological, and ecological highlights of each trail (Maine DACF, 2015c). Many of the state's parks and public reserved lands also contain hiking trails within scenic areas (Maine DACF, 2014).

Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Scenic Trails are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass" (NPS, 2012b). The Appalachian National Scenic Trail continues through Maine to complete its 2,158 mile route at Mt. Katahdin. The trail passes through scenic forests and wildlands as well as sites with cultural and historic importance. (NPS, 2015b)

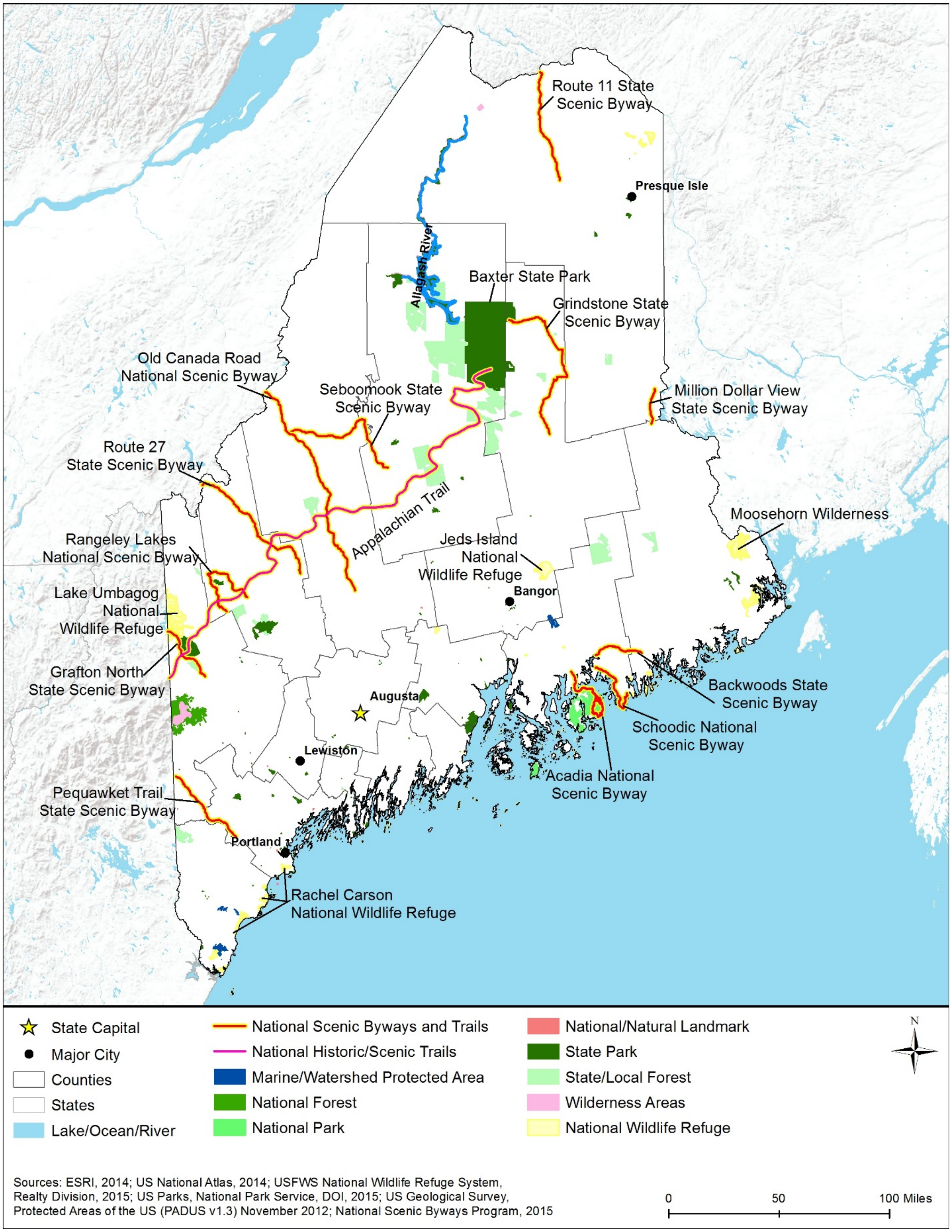


Figure 6.1.8-4: Natural Areas That May Be Visually Sensitive in Maine

6.1.8.6 Natural Areas

The abundance of natural areas varies by state depending on the amount of public or state lands managed within each state. Although many natural areas may not be managed specifically for visual resources, these areas are allowed protection for their natural resources and the resulting management protects these scenic resources.

National Wilderness Areas

In 1964, Congress enacted the Wilderness Act of 1964 as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. A designation as a National Wilderness Area is the highest level of conservation protection given by Congress to federal lands. This Act defined wilderness as land untouched by man and primarily affected only by the "forces of nature" and as that which "may also contain ecological, geological, or other features of scientific, education, scenic, or historical value." Over 106 million acres of federal public lands have been designated as wilderness areas. Twenty-five percent of these federal lands are in 47 national parks (44 million acres) and part of National Park System. Nationally, these designated wilderness areas are managed by the USDA Forest Service (USFS), Bureau of Land Management, U.S. Fish and Wildlife Service, and National Park Service. (NPS, 2015j)

Maine has one federally managed Wilderness Area, the Caribou-Speckled Mountain Wilderness, located in the White Mountains and managed by the USDA Forest Service and associated with the White Mountain National Forest (USFS, 2016).

Maine Coastal Heritage Trust Areas

The MCHT protects over 138,000 acres, including 300 coastal islands, and hundreds of miles of shoreline in partnership with other federal, state, and local agencies; private landowners; and non-government organizations. The MCHT assists landowners with protecting lands through conservation easements, the donation or sale of land, and other methods. These lands are protected for wildlife and habitat conservation, preventing development and changes in land use and the preservation of scenic resources. (MCHT, 2015)

USFWS Gulf of Maine Coastal Program

The USFWS has protected over 1.67 million acres of wetlands, coastal areas, and rivers for wild Atlantic salmon, and island habitat for nesting seabirds in coordination with other federal, state, and local agencies; private landowners; and non-government organizations. The USFWS assists with funding through grants and other sources to protect these lands for wildlife and wildlife habitat. Some lands were acquired by the MCHT and are now managed by the USFWS. (USFWS, 2006)

Rivers Designated as National or State Wild, Scenic, or Recreational

National wild, scenic, or recreational rivers are those rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-1287). The Allagash River has 93 miles designated as wild, the only river in Maine with a wild and scenic designation (Figure 6.1.8-4). This stretch of river is managed under the National Wild and Scenic Rivers Program, protecting the wild character of the river and the scenic resources surrounding it. (National Wild and Scenic Rivers System, 2015b)

National Wildlife Refuges (NWRs) and State Wildlife Management Areas

Table 6.1.8-4 identifies the over 63,000 acres of NWRs and Waterfowl Production Areas managed by the USFWS to protected plants and animal habitats from development and habitat loss in Maine (USFWS, 2015r). Visual resources within the NWRs include views and sites of the coast, beaches, wildlife, and naturally vegetated areas.

Table 6.1.8-4: NWRs in Maine[a]

Refuge Name	Acres	Scenic Resources
Aroostook	7,760	Forests, wetlands, ponds, and grasslands,
Carlton Pond Waterfowl Production Area	1,068	Pond, wetlands, and forest,
Maine Coastal Islands (5 combined): Cross Island, Franklin Island, Petit Manan, Pond Island, and Seal Island	8,200	Islands, coastlines, ocean, wetlands, grasslands, and forest
Moosehorn	20,000	Forest, hills, geologic features, shoreline, streams, lakes, and wetlands
Rachel Carson	14,600	Coastline, wetlands, forests, and beaches
Sunkhaze Meadows	11,485	Peatland bogs, wetlands, streams, and forests

[a] The Umbagog National Wildlife Refuge is on the border of New Hampshire and Maine, and is discussed in the New Hampshire section of this PEIS.

Source: (USFWS, 2015s)

There are over 50 state wildlife management areas and 9 fish hatcheries (MDIFW, 2015b). These areas contain protected habitat for plants and animals without disturbance from development and habitat loss.

National Natural Landmarks (NNLS)

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. In Maine, 14 NNLs exist within the state (Table 6.1.8-5). Some of the natural features located within these areas include Carrying Place Cove Bog, one of six recognized coastal, raised plateau bogs in the nation (NPS, 2015k).

Table 6.1.8-5: Maine National Natural Landmarks

National Natural Landmarks
Appleton Bog Atlantic White Cedar Stand
Bigelow Mountain
Carrying Place Cove Bog
Crystal Bog
Gulf Hagas
Mohegan Island
Mt. Katahdin

National Natural Landmarks
New Gloucester Black Gum Stand
No. 5 Bog and Jack Pine Stand
Orono Bog
Passadumkaeg Marsh and Bogland
Penny Pond-Joe Pond Complex
The Hermitage
Thompson Pond

Source: (NPS, 2015k)

6.1.8.7 Additional Areas

National and State Scenic Byways

National Scenic byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. The National Scenic byways Program is managed by the U.S. Department of Transportation, Federal Highway Administration (FHWA, 2015e). Maine has four designated National Scenic byways: the Old Canada Road (Route 201), Rangeley Lakes, Schoodic, and Acadia All-American Road (Figure 6.1.1-1 in Section 6.1.1, Infrastructure) (MaineDOT, 2015e).

Similar to National Scenic byways, Maine Scenic byways are transportation corridors that are of particular statewide interest. There are 10 State Scenic byways, including the Katahdin Woods & Waters (formerly Grindstone), located throughout the state. In addition, Maine is home to the Acadia byway All-American Road, 40 miles of mountain vistas and ocean views through mountainous areas (MaineDOT, 2015e).

Ecological Reserves

Ecological reserves are protected areas for conservation and study and research of ecology, wildlife, and other natural resources. There are 17 areas covering more than 90,000 acres throughout the state (identified as state land in Figure 6.1.7-2). Managed by the Bureau of Parks and Public Lands, these ecological reserves protect natural forest and woodland ecosystems (Maine DACF, 2013b).

6.1.9 Socioeconomics

6.1.9.1 Definition of the Resource

NEPA requires consideration of socioeconomics; 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 proscriptive of FirstNet's financial model or anticipated total expenditures and revenues associated with the National Public Service 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 (EO) (see Section 1.8). This Draft PEIS addresses environmental justice in a separate section (Section 6.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use and recreation (Section 6.1.7, Land Use, Recreation, and Airspace), infrastructure and public services (Section 6.1.1, Infrastructure), and aesthetic considerations (Section 6.1.8, 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. 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.

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.

6.1.9.2 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.

6.1.9.3 Communities and Populations

This section discusses the population and major communities of Maine (ME). It 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

Statewide Population and Population Growth

Table 6.1.9-1 presents the 2014 population and population density of Maine in comparison to the east region[100] and the nation. The estimated population of Maine in 2014 was 1,330,089. The population density was 43 persons per square mile (sq. mi.), which is lower than the population density of both the region (312 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Maine was the 41st largest state by population among the 50 states and the District of Columbia, 39th largest by land area, and had the 39th greatest population density (U.S. Census Bureau, 2015e; U.S. Census Bureau, 2015a).

Table 6.1.9-1: Land Area, Population, and Population Density of Maine

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Maine	30,843	1,330,089	43
East Region	237,157	73,899,862	312
United States	3,531,905	318,857,056	90

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

Population growth is an important subject for this PEIS, given FirstNet's mission. Table 6.1.9-2 presents the population growth trends of Maine from 2000 to 2014 in comparison to the east region and the nation. The state's annual growth rate greatly decreased in the 2010 to 2014

[100] The East region is comprised of the states of Connecticut, Maine, 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.

period compared to 2000 to 2010, from 0.41 percent to 0.03 percent. The growth rate of Maine in the latter period was also much less than the growth rate of the region, at 0.50 percent. Both geographies showed lower growth rates in both periods compared to the nation's growth rate (0.93 percent during 2000 to 2010, and 0.81 percent during 2010 to 2014).

Table 6.1.9-2: Recent Population Growth of Maine

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
Maine	1,274,923	1,328,361	1,330,089	53,438	1,728	0.41%	0.03%
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%

AARC = Average Annual Rate of Change (compound growth rate)
Sources: (U.S. Census Bureau, 2015f; U.S. Census Bureau, 2015e)

Demographers prepare future population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore, Table 6.1.9-3 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 Maine's population will increase by 72,209 people, or 5.4 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.33 percent, which is an intermediate value between the 2000 to 2010 growth rate of 0.41 percent and the more recent growth rate from 2010 to 2014 of 0.03 percent. The projected growth rate of the state is less than that of both the region (0.57 percent) and the nation (0.80 percent).

Table 6.1.9-3: Projected Population Growth of Maine

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
Maine	1,330,089	1,453,823	1,350,773	1,402,298	72,209	5.4%	0.33%
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%

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

Population Distribution and Communities

Figure 6.1.9-1 presents the distribution and relative density of the population of Maine. 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, 2015g).

This map also presents the 10 largest population concentrations in the state, outlined in purple. These population concentrations reflect contiguous, densely developed areas as defined by the Census Bureau based on the 2010 census (U.S. Census Bureau, 2012c; U.S. Census Bureau, 2015h). 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.

Table 6.1.9-4 provides the populations of the 10 largest population concentrations in Maine, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[101] In 2010, the largest population concentration was the Portland area, which had over 200,000 people. The state had no other population concentrations over 100,000 people. Seven of the remaining nine areas had populations between 10,000 and 100,000, and two of the areas had populations less than 10,000. The smallest of the 10 population concentrations was the Kennebunk area, with a 2010 population of 8,240. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Maine portion of the Portsmouth area. The only other area with a growth rate over 1.00 percent was the Lewiston area. Several areas experienced a population decline during this period, including the Augusta, Brunswick, Kennebunk, Rockland, and Sanford areas.

Table 6.1.9-4 also shows that the top 10 population concentrations in Maine accounted for only 33.8 percent of the state's population in 2010. However, population growth in the 10 areas from 2000 to 2010 amounted to 50.8 percent of the entire state's growth, indicating that the population growth rate in these more densely populated areas is greater than the growth rate in the remainder of the state.

[101] Census Bureau boundaries for these areas are not fixed. Area changes from 2000 to 2010 may include accretion of newly developed areas into the population concentration, Census Bureau classification of a subarea as no longer qualifying as a concentrated population due to population losses, and reclassification by the Census Bureau of a subarea into a different population concentration. Thus, population change from 2000 to 2010 reflects change within the constant area and change as the overall area boundary changes. Differences in boundaries in some cases introduce anomalies in comparing the 2000 and 2010 populations and in calculation of the growth rate presented in the table.

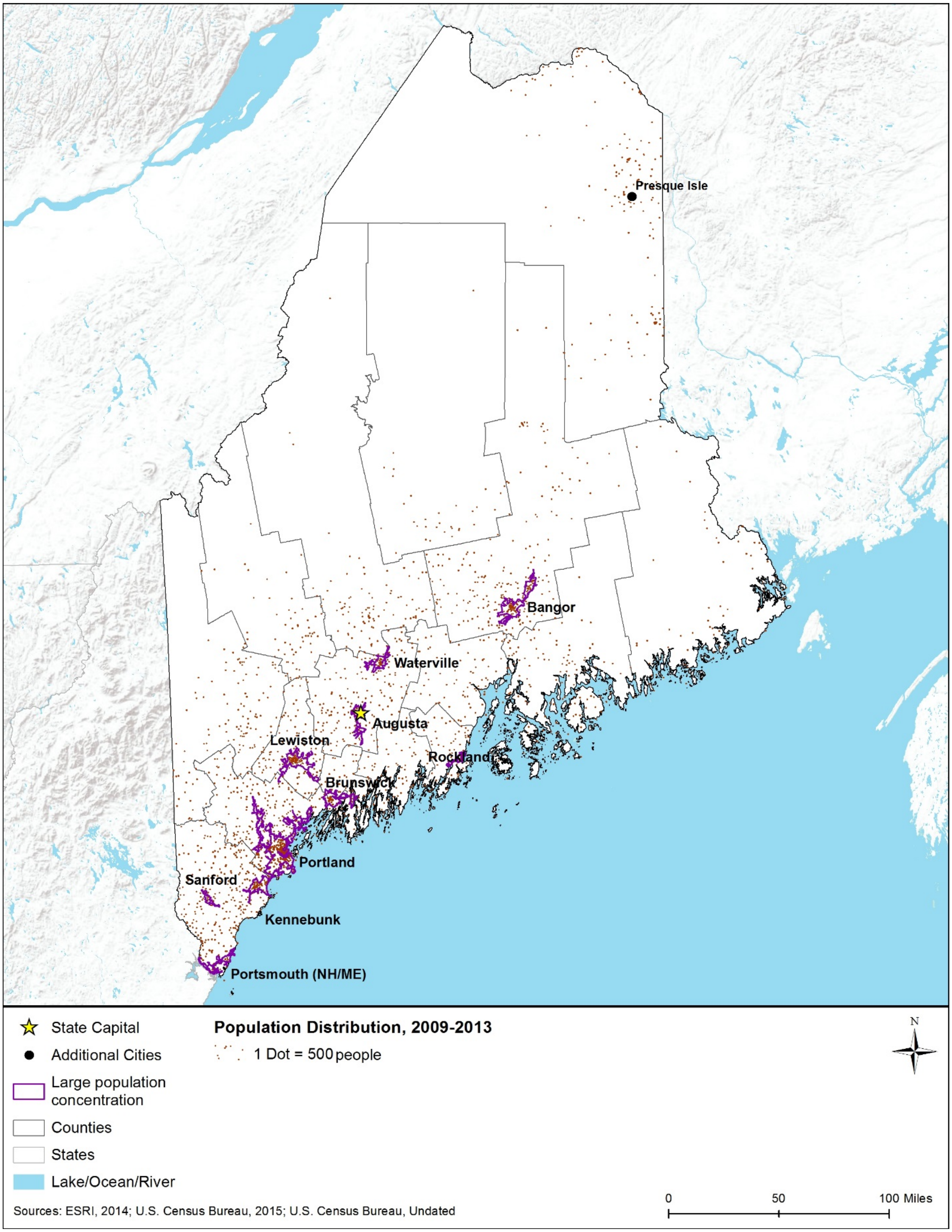


Figure 6.1.9-1: Population Distribution in Maine, 2009–2013

Table 6.1.9-4: Population of the 10 Largest Population Concentrations in Maine

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Augusta	23,897	22,637	23,262	6	(1,260)	-0.54%
Bangor	58,983	61,210	60,965	2	2,227	0.37%
Brunswick*	31,870	29,159	28,706	4	(2,711)	-0.89%
Kennebunk	8,576	8,240	8,449	10	(336)	-0.40%
Lewiston	50,567	59,397	58,510	3	8,830	1.62%
Portland	188,080	203,914	204,280	1	15,834	0.81%
Portsmouth (NH/ME) (ME Portion)**	8,929	15,791	16,779	7	6,862	5.87%
Rockland	10,619	8,775	9,103	9	(1,844)	-1.89%
Sanford	15,286	13,584	13,737	8	(1,702)	-1.17%
Waterville	24,424	25,689	25,598	5	1,265	0.51%
Total for Top 10 Population Concentrations	421,231	448,396	449,389	NA	27,165	0.63%
Maine	1,274,923	1,328,361	1,328,320	NA	53,438	0.41%
Top 10 Total as Percentage of state	33.0%	33.8%	33.8%	NA	50.8%	NA

AARC = Average Annual Rate of Change (compound growth rate)
*Population data for 2000 are for the Bath urban cluster. The towns of Bath and Brunswick form a contiguous urban cluster; the Census Bureau identified this urban cluster as “Bath” in 2000 and as “Brunswick” in 2010.
**The large population increase from 2000 to 2010 reflects a large increase in the area definition for the Portsmouth (ME portion) urbanized area, from 7.6 sq. mi. in 2000 to 17 sq. mi. in 2010.
Sources: (U.S. Census Bureau, 2012c; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j)

6.1.9.4 Economic Activity, Housing, Property Values, and Government Revenues

This section addresses other socioeconomic topics that are potentially relevant to FirstNet. These topics include:

- Economic activity
- Housing
- Property values
- 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 6.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 6.1.9-5 compares several economic indicators for Maine to the east region and the nation. The table presents two indicators of income[102] – 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 6.1.9-5, the per capita income in Maine in 2013 ($26,630) was $6,222 lower than that of the region ($32,852), and $1,554 lower than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 6.1.9-5 shows that in 2013, the MHI in Maine ($47,095) was $13,409 lower than that of the region ($60,504), and $5,155 lower than that of the nation ($52,250).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the unemployment rate as the number of unemployed individuals who are looking for work divided by the total number of individuals in the labor force. Table 6.1.9-5 compares the unemployment rate in Maine to the east region and the nation. In 2014, Maine's statewide unemployment rate of 5.7 percent was lower than the rates for the region (6.0 percent) and the nation (6.2 percent).[103]

Table 6.1.9-5: Selected Economic Indicators for Maine

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Maine	$26,630	$47,095	5.7%
East Region	$32,852	$60,504	6.0%
United States	$28,184	$52,250	6.2%

Sources: (U.S. Bureau of Labor Statistics, 2015b; U.S. Census Bureau, 2015k; U.S. Census Bureau, 2015l; U.S. Census Bureau, 2015m)

Figure 6.1.9-2 and Figure 6.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015k) and unemployment in 2014 (U.S. Bureau of Labor Statistics, 2015b) varied by county across the

[102] 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).

[103] Unemployment rates can change quarterly.

state. These maps also incorporate the same population concentration data as Figure 6.1.9-1 (U.S. Census Bureau, 2012c; U.S. Census Bureau, 2015h). Following these two maps, Table 6.1.9-6 presents MHI and unemployment for the 10 largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to those on the maps. Nonetheless, both the maps and the table help portray differences in income and unemployment across Maine.

Figure 6.1.9-2 shows that most counties in Maine have a MHI below the national median, and the counties with the lowest MHI are in the northernmost part of the state. Only three counties (York, Cumberland, and Sagadahoc), in the coastal southern portion of the state, have a MHI that is above the national median. Table 6.1.9-6 is consistent with those observations. It shows that in the Kennebunk and Portland areas, as well as the Maine portion of the Portsmouth area, the MHI was above the state average. Kennebunk is the smallest of the areas shown in the table, and is known as an affluent area; its MHI was by far the highest in the state (over $25,000 greater than the state average). MHI in the other seven population concentrations was below the state average. MHI was lowest in the Sanford and Bangor areas. Bangor is the second largest, and Sanford is the third smallest, of the areas shown in the table.

Table 6.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Maine, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Augusta	$36,888	9.8%
Bangor	$36,277	7.9%
Brunswick	$47,528	7.8%
Kennebunk	$74,256	5.6%
Lewiston	$38,907	10.0%
Portland	$51,567	6.4%
Portsmouth (NH/ME) (ME Portion)	$64,575	6.9%
Rockland	$40,256	4.6%
Sanford	$35,630	11.4%
Waterville	$37,277	12.6%
Maine (statewide)	$48,453	7.7%

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

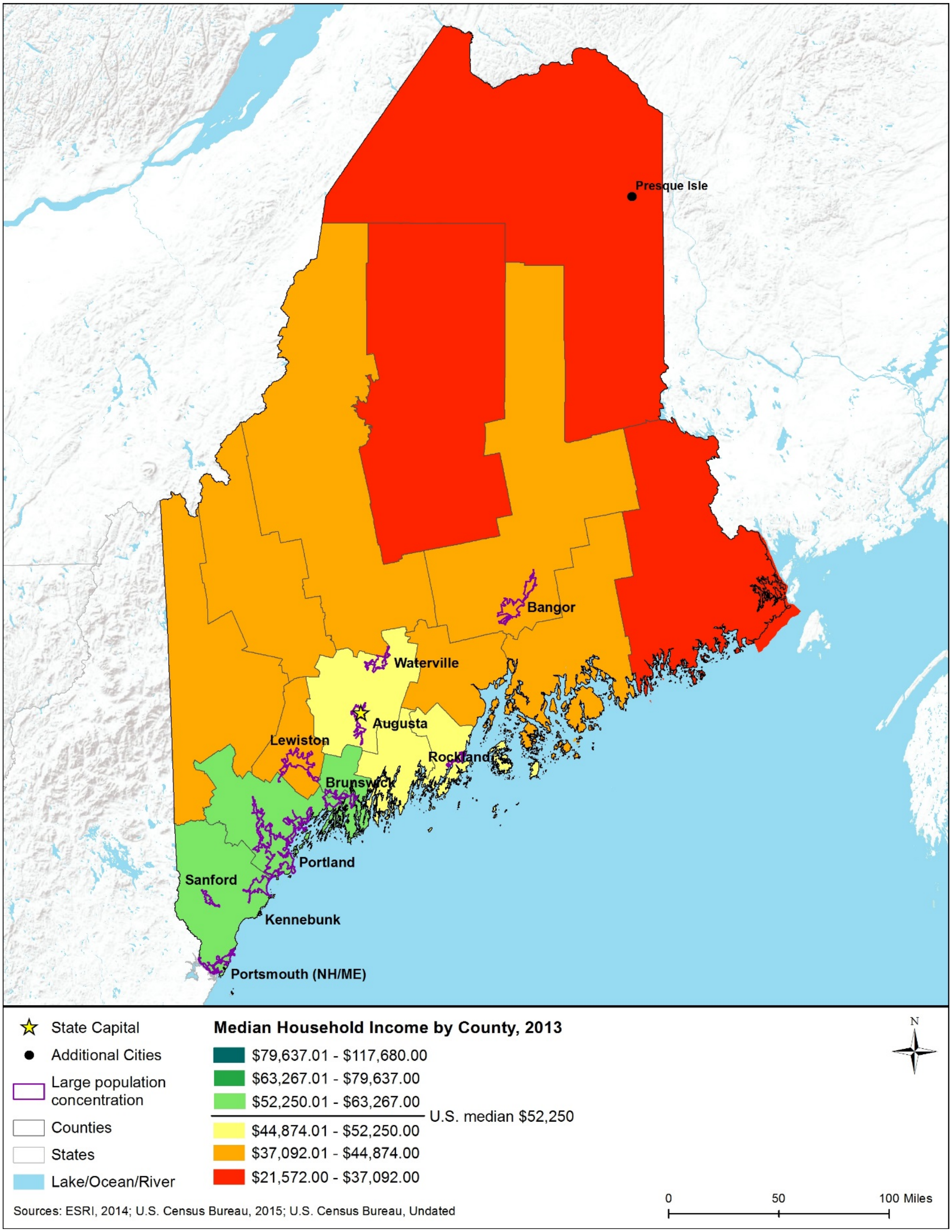


Figure 6.1.9-2: Median Household Income in Maine, by County, 2013

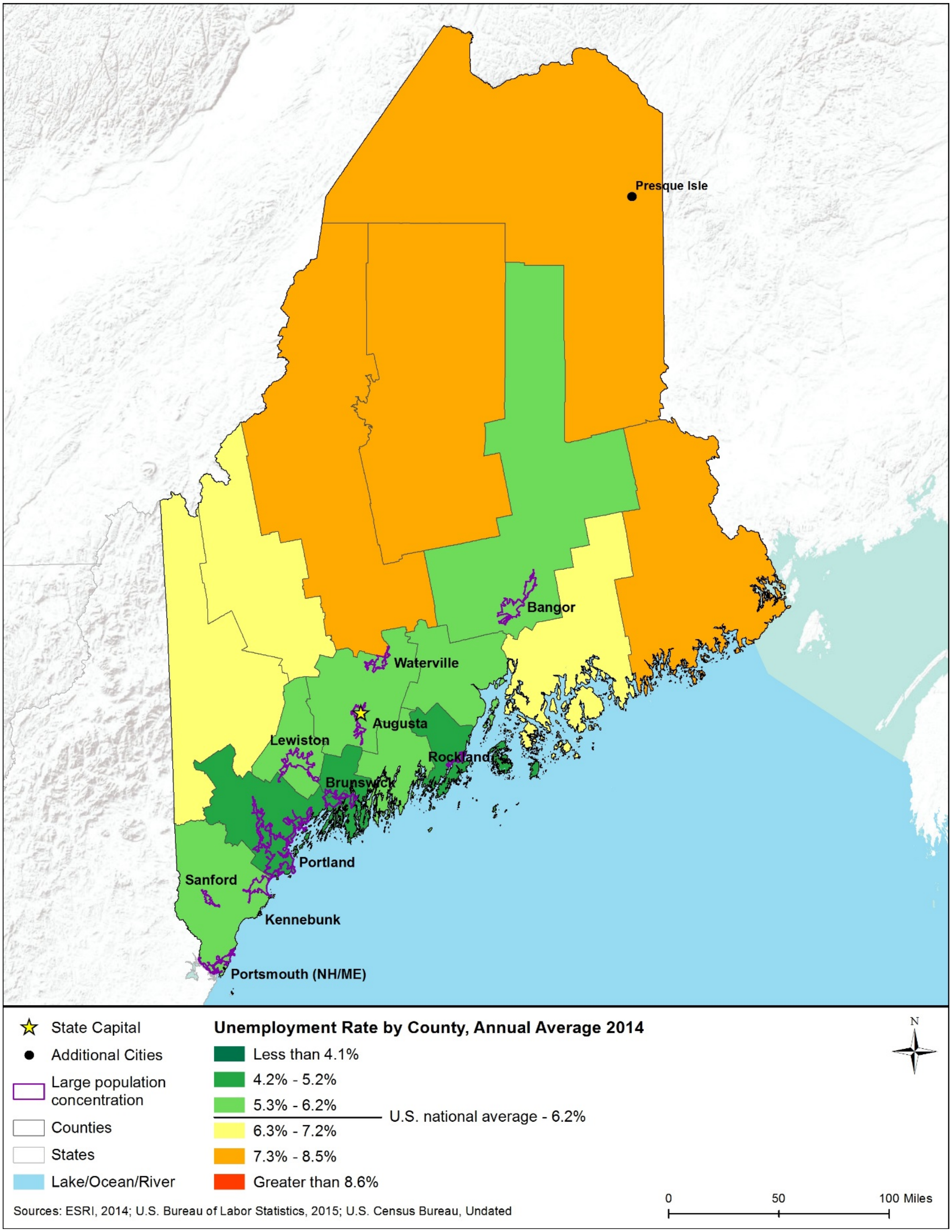


Figure 6.1.9-3: Unemployment Rates in Maine, by County, 2014

Table 6.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Maine	East Region	United States
Civilian Employed Population 16 Years and Over	643,378	35,284,908	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	77.4%	79.3%	79.7%
Government workers	14.1%	15.1%	14.1%
Self-employed in own not incorporated business workers	8.4%	5.4%	6.0%
Unpaid family workers	0.1%	0.1%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	2.6%	0.9%	2.0%
Construction	7.1%	5.8%	6.2%
Manufacturing	9.3%	8.5%	10.5%
Wholesale trade	2.4%	2.5%	2.7%
Retail trade	13.3%	11.1%	11.6%
Transportation and warehousing, and utilities	3.5%	4.6%	4.9%
Information	1.9%	2.3%	2.1%
Finance and insurance, and real estate and rental and leasing	5.8%	7.3%	6.6%
Professional, scientific, management, administrative, and waste management services	8.4%	12.3%	11.1%
Educational services, and health care and social assistance	27.6%	25.6%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	8.8%	8.9%	9.7%
Other services, except public administration	4.7%	4.9%	5.0%
Public administration	4.7%	5.5%	4.7%

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

Figure 6.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that counties with unemployment rates below the national average (that is, better employment performance) were located primarily along the southern coastal areas of the state. The highest unemployment rates were generally in the interior counties and the northern coastal counties. When comparing unemployment in the population concentrations to the state average (Table 6.1.9-6), the Augusta, Lewiston, Sanford, and Waterville areas all had a 2009–2013 unemployment rate that was considerably higher than the state average (i.e., more than 2 percent higher). The unemployment rates in the Bangor and Brunswick areas were similar to the state average of 7.7 percent, and the unemployment rates in the remaining four areas (Kennebunk, Portland, Maine portion of Portsmouth, and Rockland) were lower than the state average.

Detailed employment data provides useful insights into the nature of a local, state, or national economy. Table 6.1.9-7 provides figures on employment percentages by type of worker and by industry based on surveys conducted in 2013 by the Census Bureau. By class of worker (type of worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers was somewhat lower in Maine than in the east region or the nation. The percentage of government workers in the state was lower than in the region, and the same as in the nation. The percentage of self-employed workers was higher in the state than in the region and the nation.

By industry, Maine has a mixed economic base and the 2013 percentages of workers in the various industries were quite similar to those for the region and nation. Minor exceptions to this rule were for the percentages of people working in the “agriculture, forestry, fishing and hunting, and mining,” “retail trade,” and “educational services, and health care and social assistance” industries, all of which were higher in Maine than in the region or nation. Additionally, Maine had a lower percentage of persons working in “professional, scientific, management, administrative, and waste management services” than did the region or the nation which can be attributed to the reduced presence of these services in the state.

Table 6.1.9-8 presents employment shares for selected industries for the 10 largest population concentrations in the state. The table reflects survey data taken by the Census Bureau from 2009 to 2013. Thus, its figures for the state are slightly different from those in Table 6.1.9-7 for 2013.

Table 6.1.9-8: Employment by Relevant Industries for the 10 Largest Population Concentrations in Maine, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Augusta	5.4%	4.5%	1.5%	12.2%
Bangor	4.1%	3.0%	1.7%	6.8%
Brunswick	6.0%	2.7%	1.4%	8.3%
Kennebunk	3.5%	0.3%	3.8%	15.3%
Lewiston	6.7%	3.9%	2.9%	7.8%
Portland	4.6%	3.2%	2.4%	11.4%
Portsmouth (NH/ME) (ME Portion)	5.3%	4.8%	1.9%	10.4%
Rockland	6.3%	3.6%	1.0%	5.2%
Sanford	5.0%	2.6%	0.8%	5.9%
Waterville	7.2%	3.7%	1.7%	6.4%
Statewide	7.0%	3.9%	1.8%	8.7%

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

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 6.1.9-9 compares Maine to the east region and nation on several common housing indicators.

As shown in Table 6.1.9-9, in 2013 Maine had a considerably lower percentage of housing units that were occupied (75.7 percent) than the region (88.4 percent) or nation (87.5 percent). Of the occupied units, Maine had a considerably higher percentage of owner-occupied units (70.2 percent) than the region (62.8 percent) or nation (63.5 percent), meaning most residents own and reside in their homes. Likewise, in 2013 Maine had a higher percentage of detached single-unit housing (also known as single-family homes) (69.8 percent) compared to the region (52.7 percent) and nation (61.5 percent). The vacancy rate among rental units was higher in Maine (7.2 percent) than in the region (5.5 percent) or nation (6.5 percent).

Table 6.1.9-9: Selected Housing Indicators for Maine, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Maine	723,140	75.7%	70.2%	2.1%	7.2%	69.8%
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, 2015q)

Table 6.1.9-10 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 6.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Maine, 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
Augusta	11,984	89.7%	51.3%	2.5%	6.4%	46.1%
Bangor	27,205	92.0%	46.8%	2.0%	5.0%	45.8%
Brunswick	14,206	86.7%	62.7%	3.0%	10.6%	48.7%
Kennebunk	5,353	70.4%	76.8%	2.5%	4.0%	68.7%
Lewiston	27,136	91.3%	50.6%	3.0%	3.8%	44.6%
Portland	98,764	89.6%	57.3%	1.6%	5.1%	50.1%
Portsmouth (NH/ME) (ME Portion)	10,799	71.1%	67.7%	0.8%	8.9%	68.6%
Rockland	4,715	86.3%	62.5%	1.1%	7.1%	62.2%
Sanford	6,449	88.9%	50.7%	2.0%	8.6%	46.8%
Waterville	12,113	90.9%	53.7%	3.5%	6.7%	51.2%
Statewide	721,971	76.7%	71.8%	2.3%	7.2%	69.7%

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

Property Values

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

Table 6.1.9-11 provides indicators of residential property values for Maine 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 Maine in 2013 ($172,800) was considerably lower than the corresponding value for the east region ($249,074) and similar to the median value for the nation ($173,900).

Table 6.1.9-11: Residential Property Values in Maine, 2013

Geography	Median Value of Owner-Occupied Units
Maine	$172,800
East Region	$249,074
United States	$173,900

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

Table 6.1.9-12 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. The Kennebunk area and Portsmouth area (Maine portion) had median values (both approximately $320,000) that were nearly double the state median value ($174,500). The Portland area also had a median property value ($235,000) that was considerably higher than the state value. These three areas also had the highest median household incomes (Table 6.1.9-6). All other population concentrations had property values that were close to or below the state value. The areas with the lowest median home values were Waterville ($128,300) and Augusta ($132,700), which also had very low median household incomes (Table 6.1.9-6).

Table 6.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Maine, 2009–2013

Area	Median Value of Owner-Occupied Units
Augusta	$132,700
Bangor	$147,100
Brunswick	$185,000
Kennebunk	$318,900
Lewiston	$146,200
Portland	$235,300
Portsmouth (NH/ME) (ME Portion)	$321,400
Rockland	$166,900
Sanford	$173,200
Waterville	$128,300
Statewide	$174,500

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

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[104] 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 6.1.9-13 presents total and selected state and local government revenue sources as reported by Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures are particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure.

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

Table 6.1.9-13 shows that the state government in Maine received less total revenue in 2012 on a per capita basis than counterpart governments in the region, but more than counterparts nationwide. Likewise, for most types of revenue, the Maine state government received less per capita revenue than counterparts in the region, but more than counterparts in the nation. A notable exception is for intergovernmental revenues from federal sources; in comparison to other

[104] 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).

states in both the region and the nation, Maine received higher levels of federal intergovernmental revenues.[105] In contrast, the Maine state government received considerably lower per capita revenues from local intergovernmental sources and from public utilities taxes than counterparts in the region and the nation. Local governments in Maine also received considerably less per capita total revenue than local governments in the region and nation. Correspondingly, for nearly every revenue type listed in Table 6.1.9-13, per capita local government revenues in Maine were lower than revenues for their counterparts in both the region and nation. The only exception to this rule was for property taxes; local governments in Maine obtained higher levels of property taxes per capita than local governments in the nation (but lower levels than local governments in the region).

Table 6.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		Maine		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$8,418	$4,680	$522,354	$431,898	$1,907,027	$1,615,194
	Per capita	$6,333	$3,521	$7,132	$5,897	$6,075	$5,145
Intergovernmental from Federal	($M)	$2,884	$174	$135,435	$20,289	$514,139	$70,360
	Per capita	$2,169	$131	$1,849	$277	$1,638	$224
Intergovernmental from State	($M)	$0	$1,316	$0	$120,274	$0	$469,147
	Per capita	$0	$990	$0	$1,642	$0	$1,495
Intergovernmental from Local	($M)	$10	$0	$9,810	$0	$19,518	$0
	Per capita	$8	$0	$134	$0	$62	$0
Property Taxes	($M)	$38	$2,338	$2,215	$144,319	$13,111	$432,989
	Per capita	$29	$1,759	$30	$1,971	$42	$1,379
General Sales Taxes	($M)	$1,064	$0	$49,123	$15,874	$245,446	$69,350
	Per capita	$801	$0	$671	$217	$782	$221
Selective Sales Taxes	($M)	$684	$7	$38,070	$5,996	$133,098	$28,553
	Per capita	$515	$5	$520	$82	$424	$91
Public Utilities Taxes	($M)	$29	$7	$4,314	$2,261	$14,564	$14,105
	Per capita	$21	$5	$59	$31	$46	$45
Individual Income Taxes	($M)	$1,442	$0	$102,813	$18,838	$280,693	$26,642
	Per capita	$1,085	$0	$1,404	$257	$894	$85
Corporate Income Taxes	($M)	$232	$0	$14,112	$6,733	$41,821	$7,210
	Per capita	$175	$0	$193	$92	$133	$23

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.

Sources: (U.S. Census Bureau, 2015s; U.S. Census Bureau, 2015t)

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

6.1.10 Environmental Justice

6.1.10.1 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 (U.S. Department of Commerce, 2013).

In 1997, the Council on Environmental Quality (CEQ) issued NEPA to assist federal agencies in meeting the requirements of the EO (CEQ, 1997). Additionally, the USEPA Office of Environmental Justice (USEPA, 2015d) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015e).

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

- 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)

6.1.10.2 Specific Regulatory Considerations

The Maine DEP does not have a formal environmental justice policy, but it does implement environmental justice programs through a Performance Partnership Agreement with the USEPA (Churchill, 2015).

6.1.10.3 Environmental Setting: Minority and Low-Income Populations

Table 6.1.10-1 presents 2013 data on the composition of Maine's population by race and by Hispanic origin. The state's population has substantially lower percentages of individuals who identify as Black/African American (1.0 percent), Asian (1.1 percent), or Some Other Race (0.3

percent) than the populations of the east region and the nation. (Those percentages are, for Black/African American, 14.4 percent for the east region and 12.6 percent for the nation; for Asian, 5.8 percent and 5.1 percent respectively; and for Some Other Race, 4.8 percent and 4.7 percent respectively.) The population of individuals identifying as Two or More Races is somewhat lower in Maine (2.1 percent) than in the east region (2.7 percent) or the nation (3.0 percent). The state's population of persons identifying as White (94.9 percent) is substantially larger than that of the east region (72.1 percent) or the nation (73.7 percent).

The percentage of the population in Maine that identifies as Hispanic (1.4 percent) is substantially smaller than in the east region (12.2 percent) and the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. Maine's All Minorities population percentage (6.1 percent) is substantially lower than that of the east region (34.0 percent) or the nation (37.6 percent).

Table 6.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for Maine (14.0 percent) is somewhat higher than that for the east region (13.3 percent) and lower than the figure for the nation (15.8 percent).

Table 6.1.10-1: Population by Race and Hispanic Status, 2013

Geography	Total Population (estimated)	Race							Hispanic	All Minorities
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
Maine	1,328,302	94.9%	1.0%	0.6%	1.1%	0.0%	0.3%	2.1%	1.4%	6.1%
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%

"All Minorities" is defined as all persons who consider themselves Hispanic or of any race other than White. Because some Hispanics identify as both Hispanic and of a non-White race, "All Minorities" is less than the sum of Hispanics and non-White races.
Source: (U.S. Census Bureau, 2015u)

Table 6.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Maine	14.0%
East Region	13.3%
United States	15.8%

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

6.1.10.4 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 using data at the census-block group level; block groups are the smallest geographic units for which regularly updated socioeconomic data are readily available at the time of writing.

Figure 6.1.10-1 visually portrays the results of the environmental justice population screening analysis for Maine. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015w; U.S. Census Bureau, 2015x; U.S. Census Bureau, 2015y; U.S. Census Bureau, 2015z) and Census Bureau urban classification data (U.S. Census Bureau, 2010; U.S. Census Bureau, 2015h).

Figure 6.1.10-1 shows that Maine has many areas with high potential for environmental justice populations. The distribution of these high potential areas is fairly even across much of the state (particularly across the southern portion of the state), and occurs both within and outside of the 10 largest population concentrations. However, in the majority of the more sparsely populated areas in the northwestern and northern portions of Maine, environmental justice potential is categorized as moderate or low. Exceptions (areas with high potential) include some areas around Presque Isle.

It is important to understand how the data behind Figure 6.1.9-2 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.

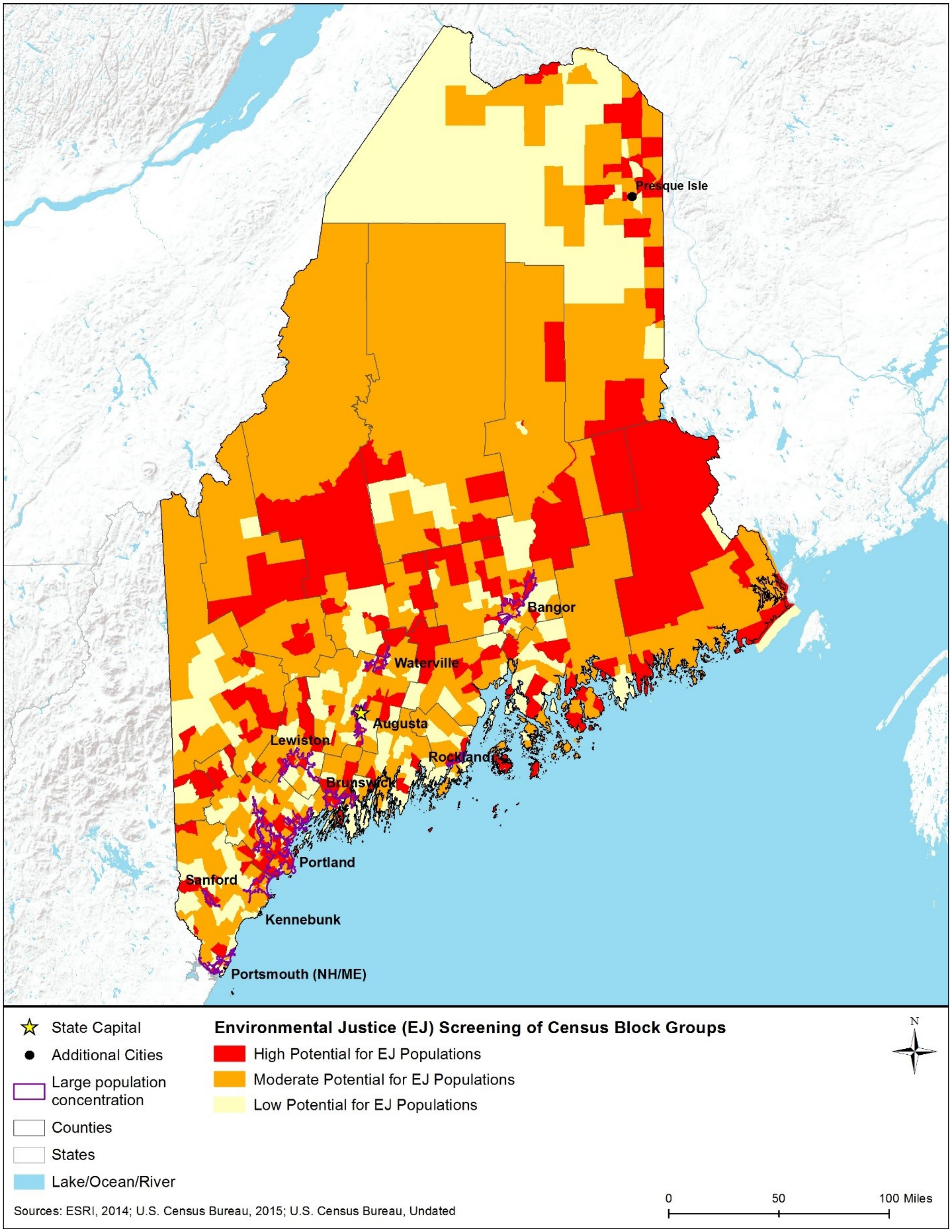


Figure 6.1.10-1: Potential for Environmental Justice Populations in Maine, 2009–2013

It is also very important to note that Figure 6.1.10-1 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). The Environmental Consequences section (Section 6.2.10) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

6.1.11 Cultural Resources

6.1.11.1 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, 2015l); 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).

6.1.11.2 Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Cultural Resources include the NHPA (detailed in Section 1.8), the American Indian Religious Freedom Act, ARPA, and NAGPRA. Appendix C summarizes these pertinent federal laws.

Maine has a state law that parallels NEPA and the NHPA (refer to Table 6.1.11-1). 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 6.1.11-1: Relevant Maine Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Maine Site Location of Development Law, Title 38, Chapter 3, §§ 481-490	Maine Historic Preservation Commission (SHPO); Maine DEP	The Maine Site Location of Development Law "requires review of developments that may have a substantial effect upon the environment. These types of development have been identified by the Legislature, and include developments such as projects occupying more than 20 acres, large structures and subdivisions, and oil terminal facilities." (Maine DEP, 2015k)

6.1.11.3 Cultural Setting

Human beings have inhabited Maine for more than 12,000 years (Pauketat, 2012; Maine Historic Preservation Commission, 2006; Spiess & Hedden, 2000; Spiess, 1990); however, due to a relatively wet climate that degrades and moves artifacts, the state's archaeological record is less reliable than records from more arid parts of the United States.

The majority of Maine's early human habitation evidence comes from the study of archeological sites of pre-European contact and historic populations. In addition to the hundreds of archaeological sites listed in the state's inventory, there are 140 archaeological sites and archaeological districts listed on the NRHP in Maine, of which there are 105 prehistoric archaeological sites, nine archaeological sites that have both prehistoric and historic context, 25 historic archaeological sites, and 1 shipwreck archaeological site. (NPS, 2016a).

Maine's pre-European contact archeological sites range from small temporary fishing camps to large permanent villages. "Resource procurement sites" from the prehistoric periods include areas where human activity may have consisted of a single action lasting for perhaps just a few hours, such as a hunting site where animals have been killed and butchered. Other sites have evidence of longer occupation, such as waterfront locations where groups of people regularly gathered to catch and prepare fish and shellfish. (Lightfoot & Cerrato, 1988; Crock, Peterson, & Anderson, 1993).

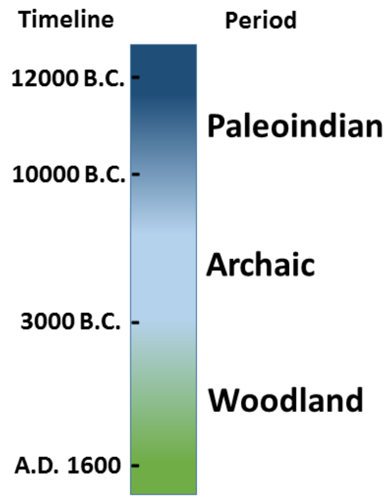
Evidence at most archeological sites in Maine is found in relatively shallow deposits, within one to two feet of the surface. However, in some cases, natural factors have buried sites beneath multiple layers of sediment or organic materials, such as in floodplain deposits found along streams and rivers or peat deposits in wetlands. These deposits can range between one and ten feet below the current surface, with older sites in the deeper sediments. Disturbed ground, including urban areas, may contain archaeological resources in deeper or shallower strata than undisturbed areas (Harris, 1979).

Archaeologists typically divide large study areas into regions, based on the environment that early humans likely occupied. As shown in Figure 6.1.3-1, Maine lies within the physiographic province of New England and physiographic province of the Appalachian Highlands. For characterizations of Maine's cultural setting, archeologists and other researchers divide the state into its three physiographic sections: New England Upland, Seaboard Lowland White Mountain.

The following information provide additional detail about Maine's prehistoric periods (approximately 12,000 B.C. to A.D. 1600) and the historic period since European colonization in the 1600s. Section 6.1.11.4 presents an overview of the initial human habitation in Maine and the cultural development that took place prior to European contact. Section 6.1.11.5 discusses the federally recognized American Indian tribes with a cultural affiliation to the state. Section 6.1.11.6 provides a current list of significant archaeological sites in Maine and tools that the state has developed to ensure their preservation. Section 6.1.11.7 summarizes the historic context of the state since European contact, and Section 6.1.11.8 addresses the architectural context of the state during the historic period.

6.1.11.4 Prehistoric Setting

There are three distinct periods associated with the prehistoric human populations that inhabited present day Maine 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 1600 A.D.) (Pauketat, 2012; Institute of Maritime History, 2015; Holiday, Johnson, & Stafford, 1999). Figure 6.1.11-1 shows a timeline representing these periods of early human habitation in North America, including present day Maine. It is important to note that there is potential for undiscovered archaeological remains representing every prehistoric period throughout the state. Evidence of human occupation has been discovered throughout the entire state. 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. 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 such a significant overlap in the timeline of human occupation in North America (Pauketat, 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, 2012; Haynes, Donahue, Jull, & Zabel, 1984; Haynes, Johnson, & Stafford, 1999).



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

Figure 6.1.11-1: Timeline of Prehistoric Human Occupation in the Maine Region

Paleoindian Period (12,000 - 10,000 B.C.)

The Paleoindian Period represents the earliest human habitation of the northeast United States. The earliest people to occupy the state were small groups of nomadic hunters and gatherers that used chipped-stone tools, including the “fluted javelin head” arrow and spear points, also referred to as the Clovis fluted point. Early hypotheses in American archaeology suggested that the Clovis fluted point was not invented until prehistoric people reached North America and began hunting the large game of that period (Spiess & Hedden, A Small Paleoindian Site in the Western Maine Foothills , 2000). However, studies that are more recent show that such technology was prevalent elsewhere in northeastern Asia, the Arabian Peninsula, and Spain prior to human arrival into North America (Charpentier & Inizan, 2002). Most of the oldest known evidence of human settlement in Maine is based on the discovery of fluted points found in surface and shallow deposits throughout the state (Spiess, Two Isolated Paleoindian Artifacts from Maine, 1990; Maine Historic Preservation Commission, 2006). Archaeologists hypothesize that the people of this period ranged across the state in small bands that followed migratory game. Early Paleoindian settlers used the Clovis fluted point technology to hunt large game such as mastodon, caribou, stag-moose, giant beaver, and California condor, to name a few species (Spiess, Two Isolated Paleoindian Artifacts from Maine, 1990; Spiess & Hedden, A Small Paleoindian Site in the Western Maine Foothills , 2000). These bands established seasonal camps, some of which likely became permanent settlements. No skeletal remains of these people have been identified to date in Maine. It is assumed that they were related to people who migrated to North America via a land bridge at the Bering Strait during the latter part of the last ice age (Late Pleistocene epoch) (Laub, 2000; Robinson, 2011).

Archaic Period (10,000 - 3,000 B.C.)

During the Archaic Period, American Indian peoples lived in small family based units throughout present day Maine. As the climate warmed, ice sheets retreated into modern day Canada, flora and fauna presently found in Maine began to be established, and the environment became increasingly more habitable for human groups and community formation. Like the Paleoindians 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 developed efficient fishing practices. Evidence of human burials from the Archaic Period has been discovered throughout Maine (Cole-Will & Will, 1996).

As presented in the sections below, the Archaic Period is subdivided into the stages of cultural development — Early, Middle, and Late — largely defined by the warming climate, expanding food resources, increasing populations, and the development of sociocultural traditions from contact with other groups through travel or trade (Levine, 2004; Maine Historic Preservation Commission, 2006).

The early part of the Archaic period was dominated by an open woodland type of environment that include spruce (*Picea*), various types of deciduous flowering plants such as Poplar (*Populus*), and American larch (*Larix*). By the Middle Archaic, these open woodlands were replaced by hemlocks (*Tsuga*), and then followed by pines (*Pinus*). During the Late Archaic Period, there was a drastic change in vegetation as hemlocks dominated the landscape again and then finally gave way to the hardwood forest much like present day Maine (Almquest-Jacobson & Sanger, 1995).

The archaeological record indicates that the people of the Early Archaic Period in Maine began to adapt to life in the forest, foraging for small game and plants. Melting runoff from glaciers formed the river systems that are present today. The people were able to take advantage of this type of terrain by harvesting fish and shellfish from the streams and rivers. Archaeologists have found “ground stone tools such as gouges, celts, axes, slate points, bayonets, and rods” (Abbe Museum, 2012). They used these tools to hunt and gather during the summer months when food was probably bountiful and groups up to 75 people lived together. As food became scarce in the winter, and with little means for storing items of subsistence, the large groups split into small bands that were better able to forage for scarce food resources. Archeological evidence of the Early Archaic Stage people in Maine consists primarily of the locations of occupation sites that once contained large campfires characterized by features containing organic remains and fire-cracked rocks, which support the hypothesis that the people were adept at hunting and large-scale cooking techniques (Almquest-Jacobson & Sanger, 1995; Pauketat, 2012; Peterson, Robinson, Belknap, Stark, & Kaplan, 1994; Will, 2002).

As mentioned previously, by the Middle Archaic Stage, the climate in Maine had moderated enough to support a forest dominated by hemlock trees and eventually by pines. The region had an abundance of food sources, including wild game, fowl, nuts, berries, tubers, roots, and herbs, which supported growing populations of semi-nomadic peoples. Based on the artifacts collected at the Richmond-Castle site in Surry, Maine, the people of this time-period were developing a sophisticated set of tools. (Cole-Will & Will, 1996; Will, 2002).

Archaeological sites of the Late Archaic Stage are well documented throughout Maine. Hardwood forests dominated the region and the subsistence base included white tail deer, black bear, small game animals, and aquatic and wild vegetable food sources. The warmer climate, and abundance and variety of food sources, gave rise to population increases by new migration of groups from outside the region or increases of indigenous populations (Peterson, Robinson, Belknap, Stark, & Kaplan, 1994; Will, Understanding Archaic Period Ground Stone Tool Technology through Debitage Analysis from the Clark 1 Site, Norridgewock, Maine, 2002).

Both stone and bone tools have been documented in the archaeological record of this stage of human occupation in Maine. Groundstone implements were used for woodworking, and for grinding and milling vegetable foods. Small-stemmed and side-notched projectile points (arrowheads), and bone tools such as fishhooks and daggers have been identified and dated to the Late Archaic Stage of human development in this region (Peterson, Robinson, Belknap, Stark, & Kaplan, 1994; Will, Understanding Archaic Period Ground Stone Tool Technology through Debitage Analysis from the Clark 1 Site, Norridgewock, Maine, 2002).

The Terminal Archaic Period is a transitional stage from the Archaic to the Woodland. Much of the same technology from the Late Archaic remains prevalent. Studies from the Quoddy Region of New Brunswick (Canada) and Maine indicate that people of this period were using canoes by this time to travel through the river systems of the region, and were beginning to exploit natural resources of the coastal environment (Sanger, 2008). Many Terminal Archaic Period archaeological sites in Maine are near marshes and coastal/riverine environments. Shell fishing became a major subsistence occupation during this time and continued throughout the Woodland Period. Recent studies have shown that the Terminal Archaic Period in this region was a time when cultures were beginning to combine into a cohesive society, with slight regional variations in their social order (Sanger, 2008).

Woodland Period (3,000 B.C. – A.D. 1600)

Similar to the Archaic Period, the Woodland Period is divided into three sequential stages: Early, Middle, and Late. The three stages are defined by phases of cultural development, based on archaeological evidence at temporal (place in time) locations. During the course of the Woodland Period, there is a gradual shift from a semi-nomadic to a more sedentary lifestyle based on horticulture or crop-growing practices (Maine Historic Preservation Commission, 2006; Fiedel, 2001).

The main technology that differentiates the Woodland Period from the Archaic Period is the development and use of pottery, which spread northward from its origins during the late Archaic from the coastal Southeast to the greater northeastern United States. This included “interior and exterior cord-marked” pottery. Hunting and fishing was the predominant form of subsistence during the Early Woodland Stage. Although agriculture is now known to have occurred during the Archaic Period, the practice of growing food for harvest was becoming more widespread throughout the region during the period. Societies were becoming much more sophisticated, and based on the well-known studies of the Hopewell culture that flourished through the Ohio

Valley, Early Woodland Period peoples in Maine began to establish intricate burial systems. (Sassaman, 1998; Fiedel, 2001).

During the Middle Woodland, there is an increase use of pottery and more ornate and intricate tools and adornment material. “Pottery with exterior designs increased the number and stylistic detail of artifacts that we can use to understand the archaeological record” (An Encyclopedia of Maine, 2015).

Hunting, fishing, and gathering continued to be the predominant way of life for the Late Woodland people of early Maine until European contact. They used birchbark canoes as their primary mode of transportation, which allowed them to trade and integrate with other cultures in the region and greater northeastern United States (Will, An Example of Late Middle Ceramic (Woodland) Period Biface Production Technology from Moosehead Lake, Maine, 1996). Because of their mobility-based culture, there are no archaeological sites that provide evidence of the development of large villages. “They combined subsistence and settlement strategies to move people to seasonally available resources, or to move food and other resources to population concentrations. Life over most of Maine was based almost entirely upon harvesting wild resources until after contact with Europeans, except in southwestern Maine where corn, bean and squash gardening was adopted by 1300 A.D.” (Maine Historic Preservation Commission, 2006).

6.1.11.5 Federally Recognized Tribes of Maine

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are four federally recognized tribes in Maine: the Aroostook Band of Micmac Indians, the Houlton Band of Maliseet Indians, the Passamaquoddy Tribe, and the Penobscot Tribe (National Conference of State Legislators, 2015; U.S. Government Publishing Office, 2015). The location of federally recognized tribes is highlighted in bold in Figure 6.1.11-2. The other tribes depicted on the figure are general locations of tribes that were known to exist in this region of the United States, but are not officially federally recognized.

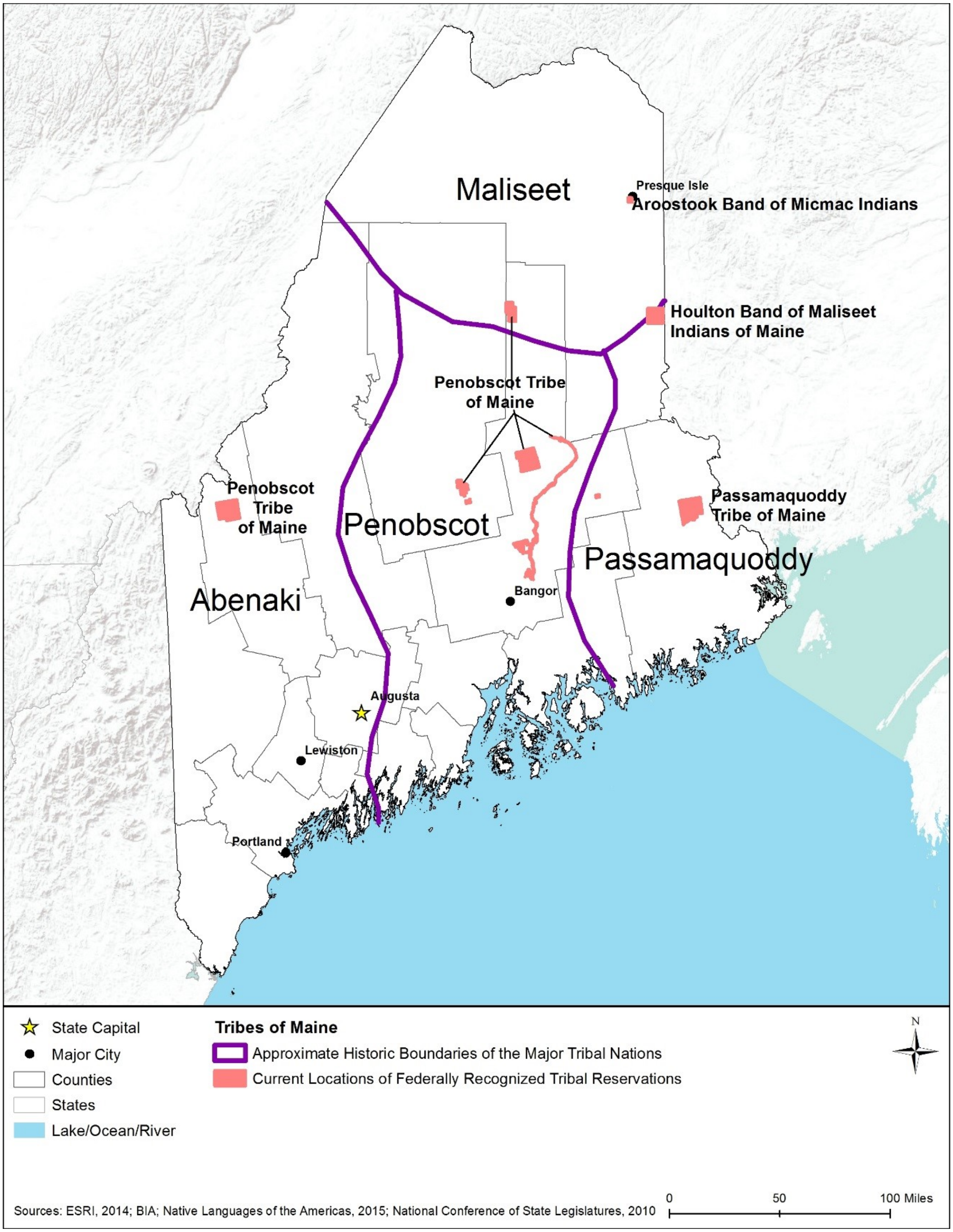


Figure 6.1.11-2: Federally Recognized Tribes in Maine

6.1.11.6 Significant Archaeological Sites of Maine

As previously mentioned in Section 6.1.11 there are 140 archaeological sites in Maine listed on the NRHP.

State of Maine - Cultural Resources Database and Tools

Maine Historic Preservation Commission (SHPO)

The Maine Historic Preservation Commission (SHPO) has various resources and materials through its website (http://www.state.me.us/mhpc/archaeology/index.html). The website makes available a wide variety of materials for those concerned about potential impacts to archaeological resources across the state. There are links to the NRHP, sources for obtaining preservation assistance, general information on the archaeology of Maine, the environmental review process, and resources for technical assistance. A list of accepted practicing archaeologists for the state is available as well. (Maine Historic Preservation Commission, 2006).

Maine Archaeological Society

The Maine Archaeological Society (MAS) also has various resources and materials through its website (http://mainearchsociety.org/). The MAS is a non-profit organization devoted to the advancement and protection of significant archaeological sites throughout the state. Their goal is to promote archaeological and cultural awareness, while providing resources to professionals and private citizens for the advancement of cultural and anthropological studies in the state. There are links to numerous archaeological publications and to previous MAS bulletins. There are also links to educational material, membership information, upcoming events with the MAS, and media release information (The Maine Archaeological Society, 2009).

Table 6.1.11-2 lists the names of the sites, the city they are closest to, and type of site. The list includes both prehistoric and historic archaeological sites. The number of archaeological sites may increase with the discovery of new sites. A current list of NRHP sites can be found on the NRHP website at http://www.nps.gov/nr/ (NPS, 2014a).

Table 6.1.11-2: Archaeological Sites on the NRHP in Maine

Closest City	Site Name	Type of Site
Ambajejus Camps	Archeological Site No. 121--52a	Prehistoric
Ambajejus Camps	Archeological Site No. 121--52B	Prehistoric
Ambajejus Camps	Archeological Site No. 121--71	Prehistoric
Auburn	Lamoreau Site	Prehistoric
Augusta	Cushnoc (ME 021.02)	Prehistoric
Augusta	Fort Western	Prehistoric
Bangor-Brewer	Penobscot Expedition Site	Prehistoric
Bath	Clarke and Lake Company Archeological Site	Prehistoric
Boothbay	Archeological Site 16.175	Historic: Non-Aboriginal
Boothbay	Archeological Site 16.198	Historic
Boothbay	Archeological Site 16.20	Historic
Boothbay	Archeological Site 16.21	Historic
Boothbay	Archeological Site 16.37 Area I and II	Prehistoric
Boothbay	Archeological Site 16.38	Prehistoric
Boothbay	Archeological Site 16.47	Prehistoric
Boothbay	Archeological Site 16.68	Prehistoric
Boothbay	Archeological Site 16.73	Historic
Boothbay	Archeological Site 16.8	Prehistoric
Boothbay	Archeological Site 26.27	Prehistoric
Boothbay	Damariscove Island Archeological Site	Historic: Aboriginal, Prehistoric
Boothbay	Taylor Site 16.65	Historic
Bristol	Nahanada Village Site	Historic - Military
Brooklin	Flye Point 2	Historic - Military
Brooklin	Goddard Site	Prehistoric
Brooksville	Von Mach Site (ME l5l/02)	Prehistoric
Calais	Devils Head Site	Prehistoric
Cape Elizabeth	Richmond's Island Archaeological Site	Prehistoric
Castine	Pentagoet Archeological District	Prehistoric
Chesuncook	Archeological Site No. 133.7	Historic: Non-Aboriginal
Chesuncook	Archeological Site No. 133.8	Prehistoric
Chesuncook	Archeological Site No. 143--23	Prehistoric
Chesuncook	Archeological Site No. 143--52	Prehistoric
Chesuncook	Archeological Site No. 143--53	Historic: Non-Aboriginal
Chesuncook	Archeological Site No. 143--57	Prehistoric
Chesuncook	Archeological Site No. 143--79	Prehistoric
Chesuncook	Willard Brook Quarry	Prehistoric
Cushing	Burton, Benjamin, Garrison Site	Prehistoric
Cushing	Gaunt Neck Site Complex	Prehistoric
Cushing	King, Thomas, Inscription	Prehistoric
Damariscotta	Damariscotta Oyster Shell Heaps	Prehistoric

Closest City	Site Name	Type of Site
Damariscotta	Damariscotta Shell Midden Historic District	Prehistoric
Deer Isle	Pond Island Archeological District	Prehistoric
Dresden	St. John's Anglican Church and Parsonage Site	Prehistoric
Eagle Lake	Big Black Site	Prehistoric
East Auburn	Irish Site	Prehistoric
East Auburn	Wilson I Site	Prehistoric
East Machias	East Machias Historic District	Prehistoric
Eddington	Eddington Bend (Site 74-8)	Historic: Non-Aboriginal
Edgecomb	Fort Edgecomb	Historic: Non-Aboriginal
Edgecomb	Fort Edgecomb (Boundary Increase)	Historic: Aboriginal, Prehistoric
Embden	Hodgdon Site	Prehistoric
Freeport	Pettengill House and Farm	Historic: Non-Aboriginal
Grand Lake Stream	Grand Lake Stream Site	Prehistoric
Grand Lake Stream Plantation	Governors Point	Historic: Military
Hudson	Young Site	Historic: Military
Indian Island	Maine Archeological Survey Site	Historic: Non-Aboriginal, Military
Islesboro	Archeological Site No. 29-64	Historic: Aboriginal
Keens Mills	Moyer Site	Historic: Non-Aboriginal, Historic: Aboriginal, Prehistoric
Keens Mills	Quartz Scraper Site	Historic: Non-Aboriginal, Historic: Aboriginal
Keens Mills	Wood Island Site	Historic: Non-Aboriginal, Prehistoric
Kennebunk	Hedden Site	Historic: Non-Aboriginal
Kittery	Isles of Shoals	Prehistoric
Lovell	Maine Archaeological Survey site 21.26	Prehistoric
Machiasport	Birch Point	Prehistoric
Machiasport	Hog Island--62.23	Prehistoric
Machiasport	Hog Island--62.24	Prehistoric
Machiasport	Hog Island--62.25	Prehistoric
Machiasport	Hog Island--62.29	Prehistoric
Machiasport	Holmes Point	Prehistoric
Machiasport	Maine Archeological Survey site 62.46	Prehistoric
Madison	Norridgewock Archeological District	Prehistoric
Manchester	Cobbosseecontee Dam Site	Prehistoric
Meddybemps	Ntolonapemk, Eastern Surplus Superfund Site	Prehistoric
Medford	Little Schoodic Stream Archeological Site (107-4)	Prehistoric
Millinocket	Archeological Site No. 122--14	Prehistoric
Millinocket	Archeological Site No. 122--16	Prehistoric
Millinocket	Archeological Site No. 122--22	Prehistoric

Closest City	Site Name	Type of Site
Millinocket	Archeological Site No. 122--6	Prehistoric
Millinocket	Archeological Site No. 122--8	Prehistoric
Millinocket	Archeological Site No. 134--8	Historic: Military
Millinocket	Archeological Site No. 134--9	Prehistoric
Millinocket	Archeological Site No. 122--4a	Prehistoric
Millinocket Lake	Munsungan-Chase Lake Thoroughfare Archeological District	Prehistoric
Milo	Brockway Site (ME 90.3)	Prehistoric
Milo	Sebec--Piscataquis River Confluence Prehistoric Archeological District	Prehistoric
New Castle	Sheepscot Historic District	Prehistoric
Newcastle	Brick House Historic District	Prehistoric
Newcastle	Dodge Point Site	Prehistoric
Newcastle	Hilton, Anne, Site	Prehistoric
Newport	Sebasticook Lake Fishweir Complex	Prehistoric
North Haven	Amesbury, Joe, Place	Prehistoric
North Haven	Bortz-Lewis Site	Prehistoric
North Haven	Bull Rock	Prehistoric
North Haven	Cabot I Site	Prehistoric
North Haven	Crocker Site	Prehistoric
North Haven	Mullen's Cove	Prehistoric
North Haven	Turner Farm II	Prehistoric
North Haven	Turner Farm Site	Prehistoric
Old Town	Gut Island Site	Prehistoric
Old Town	Hirundo Site	Prehistoric
Parkertown	Vail Site 81.1 (Boundary Increase)	Prehistoric
Parkertown	Vail Site	Prehistoric
Pejepscot	Pejepscot Site	Prehistoric
Pemaquid Beach	Colonial Pemaquid Archeological District	Prehistoric
Pemaquid Beach	Fort William Henry	Prehistoric
Pemaquid Beach	Pemaquid Restoration and Museum	Prehistoric
Pembroke	Reversing Falls Site	Prehistoric
Popham Beach	Popham Colony Site	Prehistoric
Portland	Abyssinian Meeting House	Prehistoric
Portland	Maine Archeological Site No. 9-16	Historic: Non-Aboriginal, Historic: Aboriginal
Ram Island	Big Ram Site	Prehistoric
Richmond	Swan Island Historic District	Historic: Aboriginal, Prehistoric
Ripogenus	Archeological Site No. 142--6	Historic: Non-Aboriginal, Historic: Aboriginal, Prehistoric
Ripogenus	Archeological Site No. 142--12	Historic: Non-Aboriginal

Closest City	Site Name	Type of Site
Ripogenus	Archeological Site No. 142-13	Historic: Non-Aboriginal, Historic: Aboriginal, Prehistoric
Ripogenus	Archeological Site No. 142--14	Prehistoric
Ripogenus	Archeological Site No. 142--5	Historic: Aboriginal, Prehistoric
Ripogenus	Archeological Site No. 142--8	Historic: Aboriginal
Ripogenus	Archeological Site No. 143--12	Prehistoric
Ripogenus	Archeological Site No. 143--15	Prehistoric
Ripogenus	Archeological Site No. 143--16	Shipwreck
Ripogenus	Archeological Site No. 143--5	Prehistoric
Rumford	Town of Rumford Site	Prehistoric
Searsmont	Archeological Site No. 39.1	Prehistoric
Solon	Caratunk Falls Archeological District	Historic: Non-Aboriginal
Solon	Evergreens, The	Prehistoric
South Rumford	Rumford Falls I--IV Site	Historic: Aboriginal, Prehistoric
South Rumford	Rumford Falls V Site	Prehistoric
Southwest Harbor	Fernald Point Prehistoric Site	Prehistoric
St. Croix Junction	St. Croix Island International Historic Site	Prehistoric
St. George	Allen's Island	Prehistoric
Stephensons Landing	Archeological Site No. 121--59	Prehistoric
Steuben	Atkinson-Koskinen Site 45.13	Prehistoric
Stockton Springs	Privateer Brigantine DEFENCE Shipwreck Site	Prehistoric
Sullivan	Gavin Watson Site	Prehistoric
Topsham	Hunter Site	Prehistoric
Wells	Spiller Farm Paleoindian Site	Historic
West Leeds	Cape Site	Prehistoric
Winslow	Fort Halifax	Prehistoric
Winslow	Maine Archeological Survey Site 53.36	Prehistoric

Source: *(NPS, 2015m)*

6.1.11.7 Historic Context

While Norse sailors might have explored Maine in the 11th century, Giovanni da Verrazano led the first documented European exploration in 1524. England and France made multiple colonization attempts during the late 16th and early 17th centuries, as fish and fur-bearing animals were abundant in the area. France experienced greater success early on, controlling a large portion of eastern Maine as a part of the Acadia colony. In 1621, Sir Ferdinando Gorges petitioned the English crown for a patent to establish a permanent English colony in Maine, and in 1630, settlers began arriving from England and Massachusetts. In 1674, the English portion of present day Maine came under control of the Massachusetts Bay colony, where it remained until gaining statehood in 1820. The French were driven from Maine during Queen Anne's War, which concluded in 1713 (Judd, 1995).

The population of Maine more than doubled between 1765 and 1775, following the conclusion of the French and Indian War. No major battles took place in Maine during the American Revolution; however, privateering activities were common, as the area was home to Loyalists and bordered British Canada. While most residents were supportive of the revolution, they grew weary of the conflict. During the War of 1812, Maine was subject to British raids from Halifax, and Britain temporarily gained control of the coastline. Massachusetts refused to send troops to defend the territory, which bolstered feelings of hostility between the two, increasing the push for statehood. In 1819, Maine separated from Massachusetts, and on March 15, 1820, Maine was admitted to the Union (Judd, 1995).

Throughout its history, Maine's economy has relied on the extraction of natural resources and less on farming as the soils were of poor quality throughout the state. Furring and fishing dominated initially, but lumber, lime, and granite grew during the 19th century. Ship production dominated industry, as it directly supported the fishing and shipping industries. Transportation within the state improved with the proliferation of roads during the 18th century, canals during the early 19th century, and railroads beginning in the middle of the 19th century. Increased transportation opened the interior of the state to economic exploitation, allowing natural resources from previously inaccessible areas to be brought to the market. Industrial activity and manufacturing also increased during the 19th century (Judd, 1995).

During the Civil War, "approximately seventy-three thousand Mainers served in the Union Army and Navy…, the highest figure in proportion to its population of any northern state." While no battles occurred in Maine, the state was a strong proponent of the abolitionist movement. Coastal fortifications were modernized and strengthened during the Spanish American War, and again during World War I (WWI) and World War II (WWII). Bangor International Airport, originally Godfrey Field (1927), transitioned to military use and renamed Bangor Army Air Field (and eventually Dow Air Force Base) during WWII. In 1969, the airfield returned to civilian service as Bangor International Airport (Bangor International Airport, 2015). The Bath Iron Works, a shipyard that served the military during WWII, produced 83 destroyers, which surpassed the production of any other shipyard in the country for that type of vessel (Judd, 1995).

During the late 19th and early 20th centuries, the state grew as a tourism destination for people seeking a respite from cities. Boarding houses, hotels, and private residences were constructed as train travel, and eventually automobiles, brought visitors to the state. The tourism industry suffered during the Great Depression, but rebounded following WWII. Despite this, Maine did not experience the same post-WWII building boom as the rest of the country. Maine has traditionally been a leader in the environmental movement, which has at times conflicted with development (Judd, 1995).

Maine has 1,594 NRHP listed sites, as well as 44 NHLs (NPS, 2014c). Maine contains no National Heritage Areas (NPS, 2015n). Figure 6.1.11-3 shows the locations of NRHP sites in Maine.[106]

[106] See Section 6.1.7.3 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

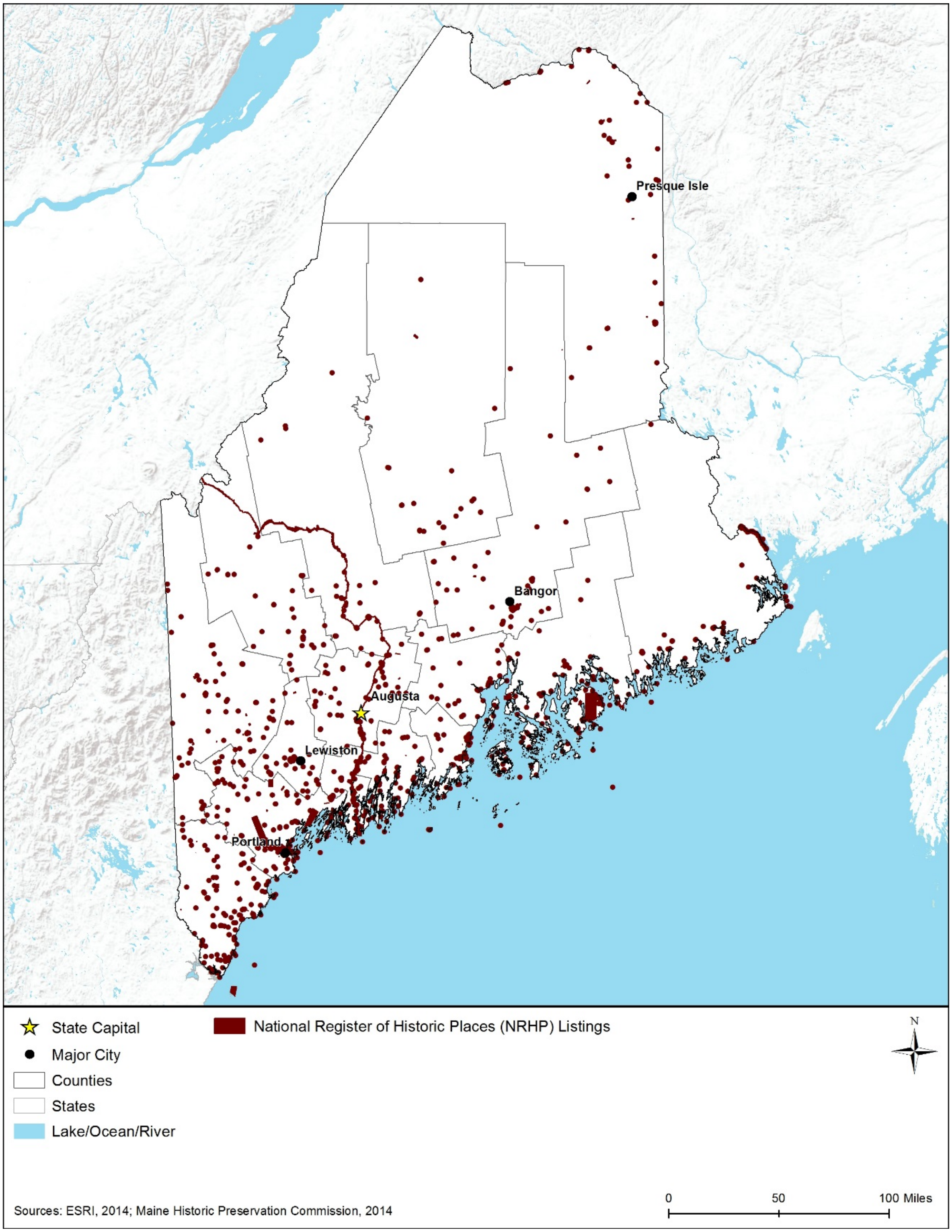


Figure 6.1.11-3: National Register of Historic Places (NRHP) Sites in Maine

6.1.11.8 Architectural Context

The earliest forms of European architecture in Maine were fortifications built by French and English settlers. Written accounts of these 17th and early 18th century settlements exist, as do drawings that depict what structures might have looked like. Post-Medieval style buildings were common, with structures built primarily of wood and stone; wood was the material of choice due to its abundance. In addition to traditional heavy timber framing, residents also lived in earth fast "log houses." These differed from the log cabins further south in that the walls of these log houses consisted of thickly sawn timbers, as opposed to hewn timbers, with no space left between each piece. Structures often featured second floor overhangs and large central chimneys. Early sawmills were established throughout Maine, as were trading posts, and "garrison houses" associated with the military. While there are no remaining 17th century structures, early 18th-century structures exist, such as the McIntire Garrison House in York, ME (ca. 1707 to 1710) (Thompson, 1976).

Beginning in the 1720s, Georgian architecture became popular. Large central chimneys remained popular initially, but end-chimneys took over as the style evolved. Second floor overhangs lost favor and sash windows replaced casement windows. In Maine, Georgian architecture matured during the 1750s and lasted through the American Revolution. The Lady Pepperrell House (1760) is an example that exists today (Beard, Smith, Bradley, & Spiess, 1982). Georgian houses in Maine sometimes featured gambrel roofs with a central chimney, and select examples, like the George Tate House in Portland (1755), included a clerestory within the roof (Thompson, 1976).

Following the American Revolution, the Federal style grew in popularity. Decorative details became lighter, windowpanes larger, and door surrounds more elaborate. The Federal style was popular in a variety of building types, from large mansions to vernacular houses. As urban areas developed, styles were adapted to fit urban and rural architectural needs, as well as commercial and institutional buildings (Thompson, 1976). Beginning in the second quarter of the 19th century, Greek Revival became one of Maine's most popular styles for residential, commercial, and institutional architecture, due to widespread growth throughout the state during the height of its popularity (Beard, Smith, Bradley, & Spiess, 1982).

Gothic Revival grew in popularity during the middle of the 19th century, particularly with respect to church architecture. The First Parish Church in Brunswick (1845) is an example. Victorian-styles became popular during the mid-to-late 19th century, especially after the Civil War, and included styles such as Italianate, Second Empire, Richardsonian Romanesque, and Queen Anne. The Shingle style was also popular in Maine, coinciding with the growth of vacation communities during Gilded Age. John Calvin Stevens built several Shingle houses along the coast (Thompson, 1976).

During the early 20th century, Colonial Revival construction grew in popularity, followed by Art Deco and Beaux Arts in more urban settings. While bungalows and ranch houses were built, they were not built in the large numbers that they were in other parts of the country. This was largely because Maine did not experience the same level of post WWII suburban growth as the rest of the country. Modern styles became popular as well in both residential and commercial architecture (Thompson, 1976).

Industrial architecture in Maine dates back to the initial settlement of the state. Lumber and gristmills were common; however, few from the early 18th century survive. During the early to-mid 19th century, the number of mills increased significantly, with most being along rivers. Greek Revival was a popular style for mill design (Thompson, 1976).

Mill villages often accompanied the mills themselves, housing and serving mill workers. Shipyards grew in importance during the 19th century, although few survive today, and lighthouse construction expanded as well, of which Maine still has many. Railroad infrastructure from the 19th century still exists. In the late 18th century, the Shaker religious community came to Maine, bringing their design principles based on functionality and utility. Buildings often appeared identical to non-Shaker buildings, but included design ideas that manifested themselves in the site plans of these compounds. The Shakers have largely died out, but Maine still hosts the last Shaker community in the country, the Sabbathday Lake Shaker Village, which was established in the 18th century, near New Gloucester and Poland, ME (Thompson, 1976).

Top Left – McIntire-Garrison House (Scotland, ME) – (Historic American Buildings Survey, 1933b)
Bottom Left – Sabbathday Lake Shaker Village (Cumberland County, ME) – (Historic American Buildings Survey, 1933c)
Middle – Cape Neddick “Nubble” Light (York, ME) – (Highsmith, 1980)
Right – George W. Bourne House (Kennebunk, ME) – (Historic American Buildings Survey, 1933a)

Figure 6.1.11-4: Representative Architectural Styles of Maine

6.1.12 Air Quality

6.1.12.1 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[107] 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)[108] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[109] This section discusses the existing air quality in Maine. The USEPA designates areas within the United States as attainment,[110] nonattainment,[111] maintenance,[112] or unclassifiable[113] 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.

6.1.12.2 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[114] or secondary,[115] for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) were developed to prevent the acute health effects from short-term exposure at high concentrations. Longer averaging periods (e.g., 3 months or annual) are intended to prevent chronic health effects from long-term exposure. A description of the NAAQS is presented in Appendix E.

In addition to the NAAQS, there are standards for hazardous air pollutants (HAP), which are those typically associated with specific industrial processes such as chromium electroplating (hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated solvents) (USEPA, 2011a). HAPs can have severe adverse impacts on human health and the

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[107] Topography: The unique features and shapes of the land (e.g., valleys and mountains).

[108] Equivalent to 1 milligram per liter (mg/L).

[109] 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, 2015q).

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

[111] 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, 2015r).

[112] 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, 2015r).

[113] 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, 2015r).

[114] 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, 2014g).

[115] 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, 2014g).

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.

In conjunction with the federal NAAQS, Maine maintains its own air quality standards, which are referred to as the Maine Ambient Air Quality Standards (AAQS). Table 6.1.12-1 presents an overview of the Maine AAQS as defined by Code of Maine Rules (CMR) 06-096, Chapter 110.

Table 6.1.12-1: Maine Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		$\mu g/m^3$	ppm	$\mu g/m^3$	ppm	
CO	8-hour	10,000	9	-	-	Standard is not to be exceeded more than once per year
	1-hour	40,000	35	-	-	
Lead	3-month	0.15	-	Same as Primary		Rolling average. Not to be exceeded
NO_2	1-hour	-	0.1	-	-	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	Annual	-	0.053	Same as Primary		Annual Mean
PM_{10}	24-hour	150	-	Same as Primary		Not to be exceeded more than once per year on average over 3 years
$PM_{2.5}$	Annual	15	-	Same as Primary		Annual mean, averaged over 3 years
	24-hour	35	-	Same as Primary		98th percentile, averaged over 3 years
O_3	8-hour	-	0.075	Same as Primary		Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
SO_2	1-hour	-	0.075	-	-	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	3-hour	-	-	-	0.5	Not to be exceeded more than once per year

Source: (Maine DEP, 2012c)

Title V Operating Permits/State Operating Permits

Maine has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. The Title V program refers to Title V of the CAA that governs permitting requirements for major industrial air pollution sources and consolidates all CAA requirements for the facility into one permit (USEPA, 2015f). The overall goal of the Title V program is to “reduce violations of air pollution laws and improve enforcement of those laws” (USEPA, 2015f). The rules at 06-096 CMR 140 describe the applicability of Title V operating permits. Maine requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 6.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014d).

Table 6.1.12-2: 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, 2014d)

Exempt Activities

Maine does not require emission licenses[116] for a minor source that generates emissions solely by "providing power for propulsion of mobile sources, including vessels" (Maine DEP, 2012d). Additionally, 06-096 CMR Chapter 115 provides a list of "insignificant activities" which are categorically exempt from obtaining an emissions license. The rules at 06-096 CMR 115 provide a list of units and activities (equipment) that are not required to be listed on the emission license but are required to be reported on the license application. Some of these units and activities relevant to the Proposed Actions include:

- "Processes, individual emission units, facilities or activities with the potential to emit less than each of the following thresholds:
    - One (1) ton per year of any single regulated criteria pollutant for any process;
    - Four (4) tons per year total regulated criteria pollutants for any process;
    - One (1) ton per year total HAPs for any individual emission unit or activity; and
    - The applicable quantity of HAPs for any facility and emission unit as specified in [06-096 CMR 115 Appendix E, Section C].
- Fuel burning equipment, including sludge dryers but excluding incinerators and stationary internal combustion engines, with a maximum design heat input of less than 1.0 million British Thermal Units per hour (MMBtu/hr) …
- Stationary Internal Combustion Engines with a maximum design heat input of less than 0.5 MMBtu/hr …
- Temporary fuel burning equipment less than 10.0 MMBtu/hr heat input installed for maintenance shut-downs, not to be used for primary steam, heating or electrical generation needs, firing fuel less than 0.05 percent sulfur, and if rented or leased less than four weeks per unit per calendar year …
- Operation, loading and unloading storage of butane, propane, or liquefied petroleum gas tanks having a capacity under forty thousand gallons …" (Maine DEP, 2012d)

Temporary Emissions Source Permits

The rule at 06-096 CMR 115, Appendix B, Section A.114, identifies some temporary air emission-related activities that can be considered as an insignificant activity and are categorically exempt from obtaining an emission license. Maine DEP must approve these temporary air emission-related activities prior to the installation and operation of a temporary source. Additionally, temporary fuel burning equipment that does not meet the heat input (<10.0

[116] Emission License: A document required for all applicable major and minor sources that compiles all applicable air quality related requirements from states and federal regulations for a specific facility.

MMBtu/hr) and fuel standard (<0.05 percent sulfur) must obtain an emission license (Maine DEP, 2012d).

State Preconstruction Permits

Any major source or potential major source must obtain preconstruction authorization, “and in no case shall a major source be exempted from the obligation to obtain an air emission license” (Maine DEP, 2012d). Some minor sources are also required to obtain an air emissions license. Facilities that generate emissions solely by one or more of the following are required to obtain an air emission license:

- “Fuel-burning equipment (or combinations thereof), whose total maximum design heat input is equal to or greater than 10.0 MMBtu/hr. Fuel-burning equipment, excluding stationary internal combustion engines, less than 1.0 MMBtu/hr shall not be included in this threshold assessment and stationary internal combustion engine less than 0.5 MMBtu/hr shall not be included in this threshold assessment.
- Stationary internal combustion engines (or combinations thereof) whose total maximum design heat input is equal to or greater than 5.0 MMBtu/hr or a gas/propane fired stationary internal combustion engine (or combination thereof) with a total maximum design heat input of equal to or greater than 10.0 MMBtu/hr. Units less than 0.5 MMBtu/hr shall not be included in this threshold assessment.
- Total facility general process sources whose emissions without consideration of air pollution control apparatus and under normal operation are equal to or greater than 100 lb/day of any regulated pollutant, except that these numerical limitations may not apply to a source which is subject to regulation for the control of hazardous air pollutants pursuant to Title 38 MRSA Section 585-B, New Source Performance Standards promulgated at 40 CFR Part 60, or NESHAPS promulgated at 40 CFR Part 61 and 63.
- Total facility general process sources whose emissions without consideration of air pollution control apparatus and under normal operation are equal to or greater than 10 lb/hr of any regulated pollutant, except that these numerical limitations may not apply to a source which is subject to regulation for the control of hazardous air pollutants pursuant to Title 38 MRSA Section 585-B, New Source Performance Standards promulgated at 40 CFR Part 60, or NESHAPS promulgated at 40 CFR Part 61 and 63.” (Maine DEP, 2012d)

All major sources or new sources that may potentially be considered a major source must obtain an emissions license; however, some major sources may be exempt from conducting preconstruction air quality monitoring. According to 06-096 CMR 115(7)(D)(1)(d), major sources are exempt from conducting preconstruction monitoring if the “emissions increase of a pollutant would cause, in every area, air quality impacts less than the following amounts” detailed in Table 6.1.12-3 (Maine DEP, 2012d).

Table 6.1.12-3: Major Air Pollutant Source Thresholds

Pollutant	Averaging Time	Maximum Increase ($\mu g/m^3$)
CO	8-hour	575
NO_2	Annual	14
SO_2	24-hour	13
O_3 [a]	-	-
Lead	24-hour	0.1
Mercury	24-hour	0.25
Beryllium	24-hour	0.0005
Fluorides	24-hour	0.25
Vinyl chloride	24-hour	15
Total reduced sulfur	1-hour	10
Hydrogen sulfide	1-hour	0.04
Reduced sulfur compounds	1-hour	10
Chromium	24-hour	0.02
$PM_{2.5}$	24-hour	4
PM_{10}	24-hour	10

[a] "No *de minimis* air quality level is provided for O_3. Any Major sources having a net emissions increase of 100 tpy or more of Volatile Organic Compounds (excluding negligibly photo-chemically reactive VOC) shall conduct ambient air monitoring except that when such Major source satisfies the condition of 40 CFR Part 51, Appendix S, Section IV, post approval monitoring data for ozone may be substituted for preconstruction data."

Source: (Maine DEP, 2012d)

General Conformity

Established under Section 176(c)(4) of the CAA, the General Conformity Rule ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality outlined in the state implementation plan (SIP) (USEPA, 2013a). An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and (e), federal actions "in response to emergencies which are typically commenced on the order of hours or days after the emergency" and actions "which are part of part of a continuing response to emergency or disaster" that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (U.S. Government Publishing Office, 2010).

The estimated pollutant emissions are compared to *de minimis* levels. These values are the minimum thresholds for which a conformity determination must be performed (Table 6.1.12-4). All Maine 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 6.1.12-4: *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

Pollutant	Area Type	TPY
	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: (U.S. Government Publishing Office, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 6.1.12-4, 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 6.1.12-4, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity[117], 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

Maine's SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. According to the USEPA, "states that are part of the Ozone Transport Region [OTR] were required to submit SIPs to meet the 1997 ozone Reasonably Available Control Technology (RACT) requirement for the entire state. The RACT requirement applies to all areas within the Ozone Transport Region [OTR], regardless of the areas designation for the 1997 ozone standard" (USEPA, 2012b). Maine's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Maine's SIP actions are codified under 40 CFR Part 52 Subpart HH and listed on the USEPA's website (USEPA, 2015g).

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

6.1.12.3 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 6.1.12-1 and

Table **6.1.12-5**, below, present the current nonattainment areas in Maine as of January 30, 2015.

Table **6.1.12-5** contains a list of the counties and their respective October 2015 nonattainment status for each criteria pollutant. The year(s) listed in the table for each pollutant indicate the date(s) when USEPA promulgated an ambient air quality standard for that pollutant. Note certain pollutants have more than one standard in effect (e.g. for $PM_{2.5}$, O_3, and SO_x). Unlike

Table **6.1.12-5**, Figure 6.1.12-1 does not differentiate between standards for the same pollutant. Additionally, given that particulate matter is a criteria pollutant of concern, PM_{10} and $PM_{2.5}$ are merged in the figure and presented as a single pollutant.

Table 6.1.12-5: Maine 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	1979	2008	1971	1987	1997	2006	1997	2008	1971	2010
Androscoggin								M			
Aroostook					M						
Cumberland								M			
Hancock								M			
Knox								M			
Lincoln								M			
Penobscot										M	
Sagadahoc								M			
Waldo								M			
York								M			

X-1 = Nonattainment Area (Extreme)
X-2 = Nonattainment Area (Severe)
X-3 = Nonattainment Area (Serious)
X-4 = Nonattainment Area (Moderate)
X-5 = Nonattainment Area (Marginal)
X-6 = Nonattainment Area (Unclassified)
M = Maintenance Area

Source: (USEPA, 2015h)

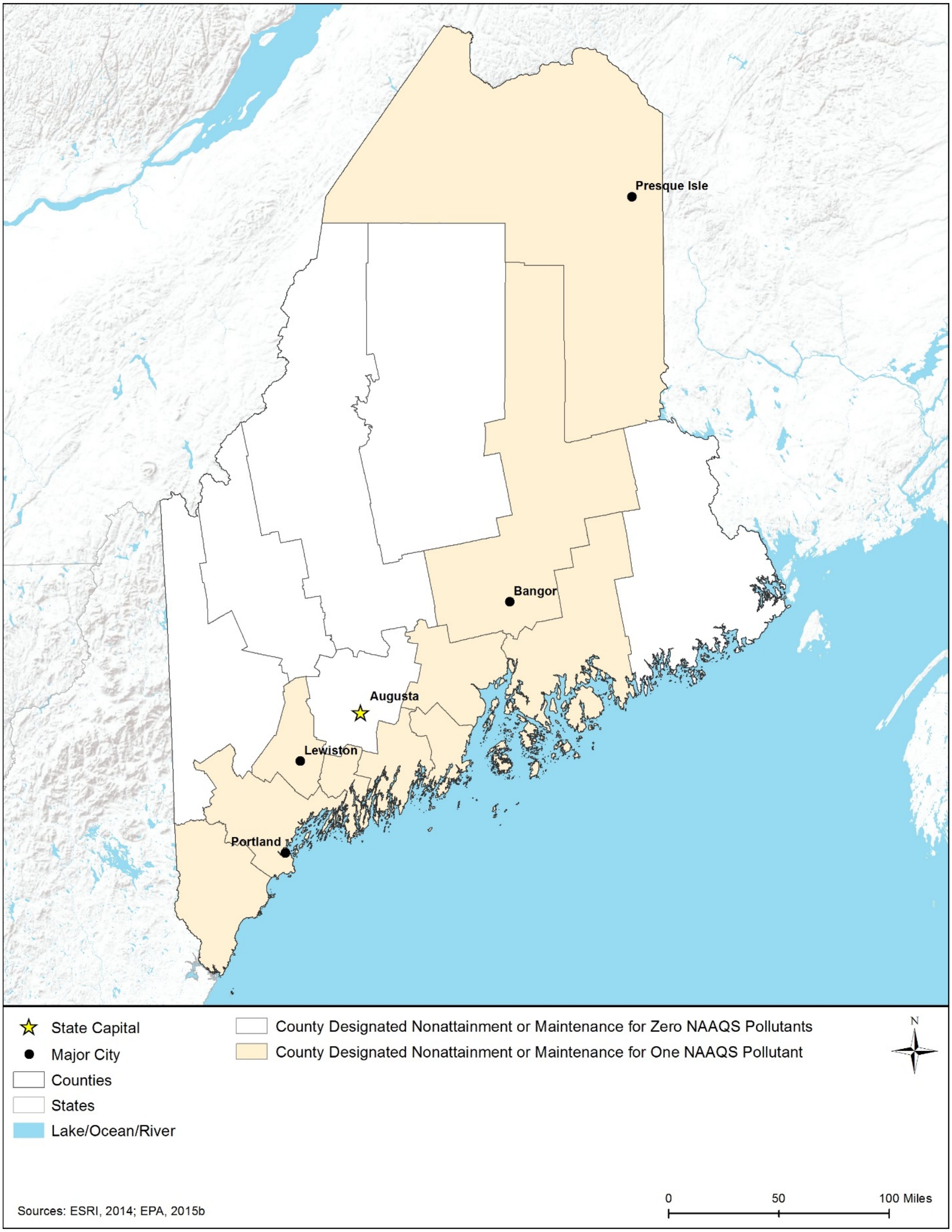


Figure 6.1.12-1: Nonattainment and Maintenance Counties in Maine

Air Quality Monitoring and Reporting

The Maine DEP Bureau of Air Quality and the Tribal Nations measure air pollutants at 34 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Maine DEP prepares Annual Maine Ambient Air Quality Reports containing pollutant data summarized by region (Maine DEP, 2013c). Maine DEP reports real-time pollution levels of O_3 on their website to inform the public, as O_3 is the main pollutant of concern in Maine: http://www.maine.gov/dep/air/ozone/currentdata.html.

There were zero O_3 exceedances in 2014. Throughout 2013, O_3 measurements exceeded the federal standard of 0.075 ppm 15 times. The Kennebunkport and Port Clyde monitoring stations experienced the highest frequency of O_3 exceedances (four in 2013); while Cape Elizabeth recorded three exceedances above the federal standard (Maine DEP, 2013c).

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 the USEPA developed the standards for a Class III AQCR, to date they have not actually classified any area as Class III. Therefore, any area that is not classified as a Class I area is, by default, automatically designated as a Class II AQCR (USEPA, 2013b).

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[118] of a Class I area. "The [US]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 the 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 [US]EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 100 kilometers[119] (the normal useful range of [US]EPA-approved Gaussian plume models" (USEPA, 1992).

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

Maine contains two federal Class I areas, Acadia National Park (37,503 acres) and the Moosehorn Wilderness Area (7,501 acres). The Moosehorn Wilderness Area is comprised of two units, the Edmunds Unit (2,782 acres) and the Baring Unit (4,719 acres). Figure 6.1.12-2 depicts the location of Acadia National Park and the Moosehorn Wilderness Area. Additionally, there are three other Class I areas located within 100 kilometers of Maine. New Hampshire contains two Class I areas located near the Maine border; the Great Gulf Wilderness Area and the presidential range-Dry River Wilderness Area.

Maine is also located within 100 kilometers of the Roosevelt Campobello International Park located in Nova Scotia, Canada. Similar to the requirement mentioned above, by which the FLM would notify the USEPA Regional Office of any project within 100 kilometers of a Class I area, the U.S. and Canada have agreed to notify each other under similar circumstances. Pursuant to the 1991 Canada-U.S. Air Quality Agreement, if a new industrial source is constructed or modified within 100 kilometers of the border, the country constructing the facility must notify the other. USEPA Regional Offices will inform the Office of Air Quality Planning and Standards (OAQPS) of any new or modified major sources, and OAQPS will notify Canada. (Page, 2012)

Table 6.1.12-6: Relevant Federal Class I Areas

#[a]	Area	Acreage	State/Country
1	Acadia National Park	37,503	ME
2	Moosehorn Wilderness Area (Edmunds Unit) (Baring Unit)	7,501 (2,782)[b] (4,719)[b]	ME
3	Roosevelt Campobello International Park	2,720	Canada[c]
4	Great Gulf Wilderness Area	5,552	NH
5	Presidential Range-Dry River Wilderness Area	20,000	NH

[a] The numbers correspond to the shaded regions in Figure 6.1.12-1.
[b] The Moosehorn Wilderness Area is comprised of two sub-units, the Edmunds and Baring units respectively.
[c] Canada is not a Federal Class I area, but identified as a Class I area under the 1991 Canada-U.S. Air Quality Agreement.
Source: (USEPA, 2012c)

In addition to national and state AAQS, the criteria pollutants ($PM_{2.5}$, PM_{10}, SO_2, and NO_2) are subject to maximum allowable increases in concentrations above the baseline concentration. There are different concentration increases allowed based on the AQCR. Table 6.1.12-7 details the maximum allowable increase in concentration of $PM_{2.5}$, PM_{10}, SO_2, and NO_2 over the baseline concentration for Class I, II, and III areas within Maine.

Table 6.1.12-7: Maximum Allowable Increase in Pollutant Concentrations, by AQCR

Pollutant	Averaging Time	Maximum Allowable Increase (μg/m^3)			Notes
		Class I	Class II	Class III	
$PM_{2.5}$	Annual	1	4	8	Not to be exceeded.
	24-hour	2	9	18	Do not exceed more than once per year.
PM_{10}	Annual	4	17	34	Not to be exceeded.
	24-hour	8	30	60	Do not exceed more than once per year.
SO_2	Annual	2	20	40	Not to be exceeded.
	24-hour	5	91	182	Do not exceed more than once per year.
	3-hour	25	512	700	Do not exceed more than once per year.
NO_2	Annual	2.5	25	50	Not to be exceeded.

Source: (Maine DEP, 2012c)

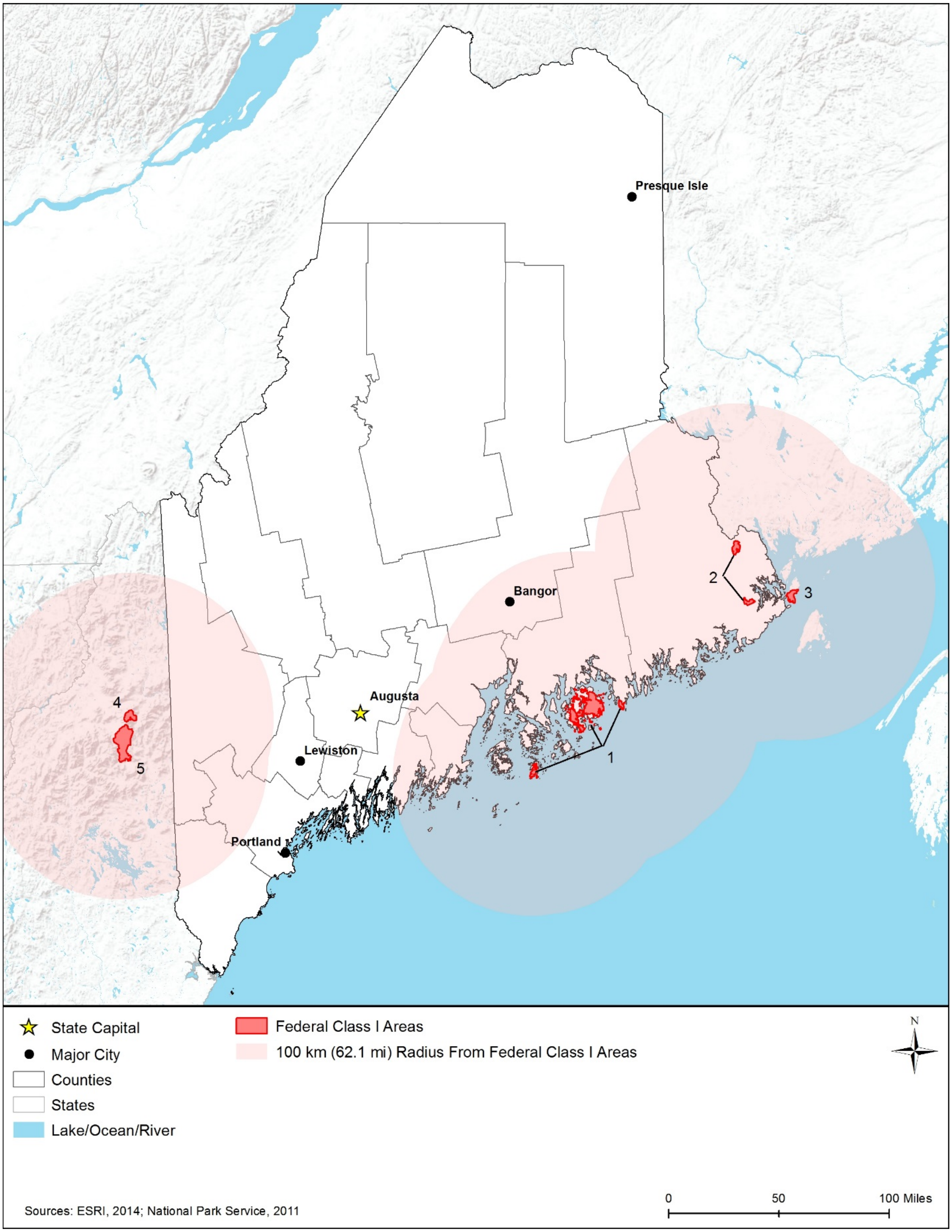


Figure 6.1.12-2: Federal Class I areas in Maine

6.1.13 Noise

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

6.1.13.1 Definition of the Resource

Noise is caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 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.

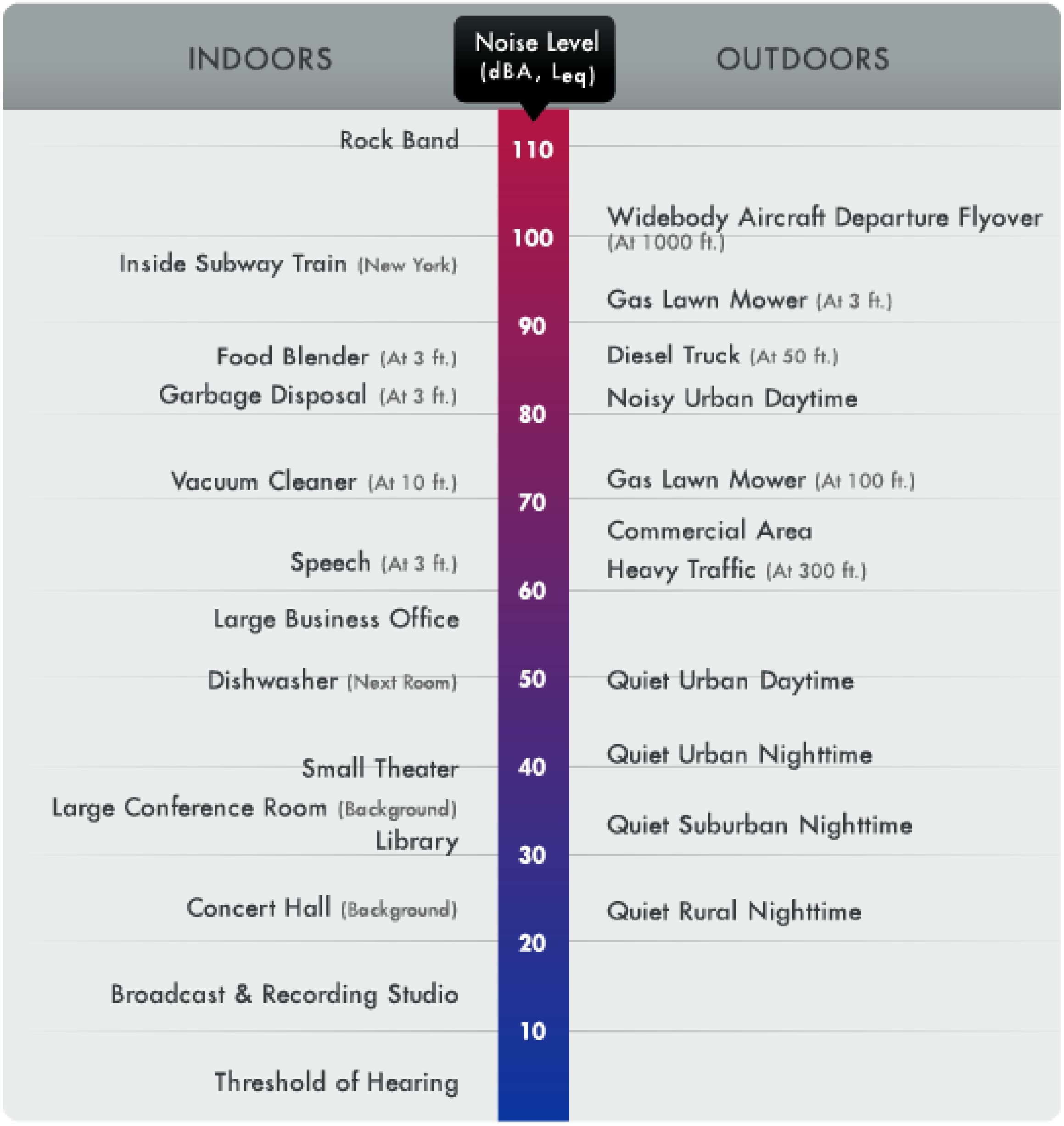
Fundamentals of Noise

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

Figure 6.1.13-1 presents the sound levels of typical events that occur on a daily basis in the environment. For example, conversational speech is measured at approximately 55 to 60 dBA, whereas a band playing loud music may be as high as 120 dBA.



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

Figure 6.1.13-1: Sound Levels of Typical Sounds

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 approximately 10 dB (USEPA, 1973). Ambient noise levels can differ considerably depending on whether the environment is urban, suburban, or rural.

6.1.13.2 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.

Maine has two statewide noise laws, but they are restricted to operation of snowmobiles and ATVs (Maine State Legislature, 2015)*;* neither would apply to FirstNet projects. However, many cities and towns may have local noise ordinances to manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Large cities and towns, such as Portland, 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).

6.1.13.3 Environmental Setting: Ambient Noise

The range and level of ambient noise in Maine varies widely based on the area and environment of the area. The population of Maine can choose to live and interact in areas that are large cities, rural communities, and national and state parks. Figure 6.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Maine may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Maine. As such, this section describes the areas where the population of Maine 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) (U.S. Department of Interior, 2008). The areas that are likely to have the highest ambient noise levels in the state are Portland, Lewiston, Bangor, South Portland, and Auburn.

- **Airports:** Areas surrounding airports tend to be more sensitive to noise due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to

160 dBA in its direct proximity (FAA, 2015g). 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 are in the proximity of urban communities; therefore, aircraft operations (arrivals/departures) can result in noise exposure in the surrounding areas to be at higher levels with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In Maine, Portland International Jetport (PWM), Bangor International (BGR), and Northern Maine Regional Airport at Presque Isle (PQI) have more than 88,000 annual operations combined, with PWM accounting for approximately 46,600 operations annually (FAA, 2015b). These operations result in increased ambient noise levels in the surrounding communities. See Section 6.1.1, Infrastructure, and Figure 6.1.7-5 to Figure 6.1.7-7 for more information about airports in the state.

- **Highways:** Communities near major highways also experience higher than average noise levels when compared to areas that are not in close proximity to a highway (FHWA, 2015f). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living in those areas. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA, 2015f). See Section 6.1.1, Infrastructure, and Figure 6.1.1-1 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 (Federal Railroad Administration, 2015). Maine has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend from Bangor to Kittery, Fryeburg to Ellsworth, Belfast to Jackman, Belfast to Millinocket, and Brownville Junction to Madawaska. There are also a number of other rail corridors that join these major rail lines and connect with other cities (MaineDOT, 2013). See Section 6.1.1, Infrastructure, and Figure 6.1.1-1 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 more remote or wilderness areas. National and state parks, historic areas, and monuments are protected areas with one of their functions being to "maintain the resilience of the national soundscape"[120] (Freimund, 2009). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014d). Maine has one national park, 14 National Natural Landmarks, and other NPS-managed areas (NPCA, 2016) (NPS, 2015o). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 6.1.7, Land Use, Recreation, and Airspace and Section 6.1.8, Visual Resources, for more information about national and state parks in Maine.

6.1.13.4 Sensitive Noise Receptors

Noise-sensitive receptors include residences, schools, medical facilities, places of worship, libraries, churches, nursing homes, concert halls, playgrounds, and parks. Sensitive noise receptors are typically areas where the intrusion of noise can disrupt the use of the environment. A quiet urban area usually has a typical noise level in the daytime of 50 dBA, and 40 dBA during the evening. Noise levels in remote wilderness and rural nighttime areas are usually 30 dBA (BLM, 2014). Most cities, towns, and villages in Maine 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 in the Maine.

6.1.14 Climate Change

6.1.14.1 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[121]), which equalizes for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units will be in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units will be in MMT CO_2e.

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[120] A soundscape is the acoustic environment that encompasses an area, and includes natural and human/man-made sounds.

[121] 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, 2015e).

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 approximately 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 6.2.14 Environmental Consequences). Existing climate conditions in the project area are described first by state and sub-region, where appropriate, and then by future projected climate scenarios. The discussion focuses on the following climate change impacts: 1) temperature; 2) precipitation; 3) sea level; and 4) severe weather events (including tropical storms, tropical cyclones, and hurricanes).

6.1.14.2 Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C. Maine and the City of Portland, Maine have established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 6.1.14-1, two key state laws are the primary policy drivers on climate change preparedness and GHG emissions.

Table 6.1.14-1: Relevant Maine Climate Change Laws and Regulations

State Laws/Regulation	Regulatory Agency	Applicability
Title 38, Waters and Navigation, Chapter 3-A: Climate Change, §576. Reduction Goals	Maine State Legislature	Title 38, Waters and Navigation, Chapter 3-A: Climate Change, §576. Reduction Goals sets Maine's reduction goals for GHG emissions as follows: 1) "Reduction by 2010. In the short term, reduction to 1990 levels by January 1, 2010; 2) Reduction by 2020. In the medium term, reduction to 10% below 1990 levels by January 1, 2020; and 3) Long-term reduction. In the long term, reduction sufficient to eliminate any dangerous threat to the climate. To accomplish this goal, reduction to 75% to 80% below 2003 levels may be required (Maine Office of the Reviser of Statues, 2015)."
Title 38: Waters and Navigation, Chapter 3-A: Climate Change, §577. Climate Action Plan	Maine State Legislature	Title 38: Waters and Navigation, Chapter 3-A: Climate Change, §577. Climate Action Plan states that by July 1, 2004, the department, with input from stakeholders, was to adopt a state climate action plan to meet the reduction goals specified in Section 576. "The action plan must address reduction in each sector in cost-effective ways and must allow sustainably managed forestry, agricultural and other natural resource activities to be used to sequester GHG emissions (Maine Office of the Reviser of Statues, 2015)."

Maine 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).

Additionally, Portland, Maine is a part of the U.S. Mayors Climate Protection Agreement in which participants are urged to enact policies and programs to meet or beat the target of reducing global warming pollution levels to seven percent below 1990 levels by 2012. Portland exceeded this goal by reducing emissions by 10 percent below 1990 levels by 2012 (City of Portland, Maine, 2015a). The City of Portland also developed a Climate Adaption Plan (2008) and completed a draft framework for a Sea Level Rise Adaption Plan, which was presented to the Transportation, Sustainability, and Energy Committee in December 2010 with a number of policy questions and options (City of Portland, Maine, 2015b).

6.1.14.3 Maine Greenhouse Gas Emissions

According to the U.S. Energy Information Agency (EIA), Maine emitted a total of 16.2 MMT of CO_2 in 2013. Transportation was the largest emitter, accounting for more than 75 percent of total CO_2 emissions (Table 6.1.14-1) (EIA, 2015d). Maine's CO_2 emissions rose and fell between 1980 and 1989 before achieving a steady state around 18 and 19 MMT until 1999 when they began to increase. They reached a maximum of 23,9 in 2004 and then declined to 15.5 MMT in 2012. Overall declines have been driven by reductions in petroleum and coal use, even as the use of natural gas has increased. In 2013 Maine ranked 45th among the fifty states and the District of Columbia for total CO_2 emissions, and 37th for per-capita CO_2 emissions (EIA, 2015e).

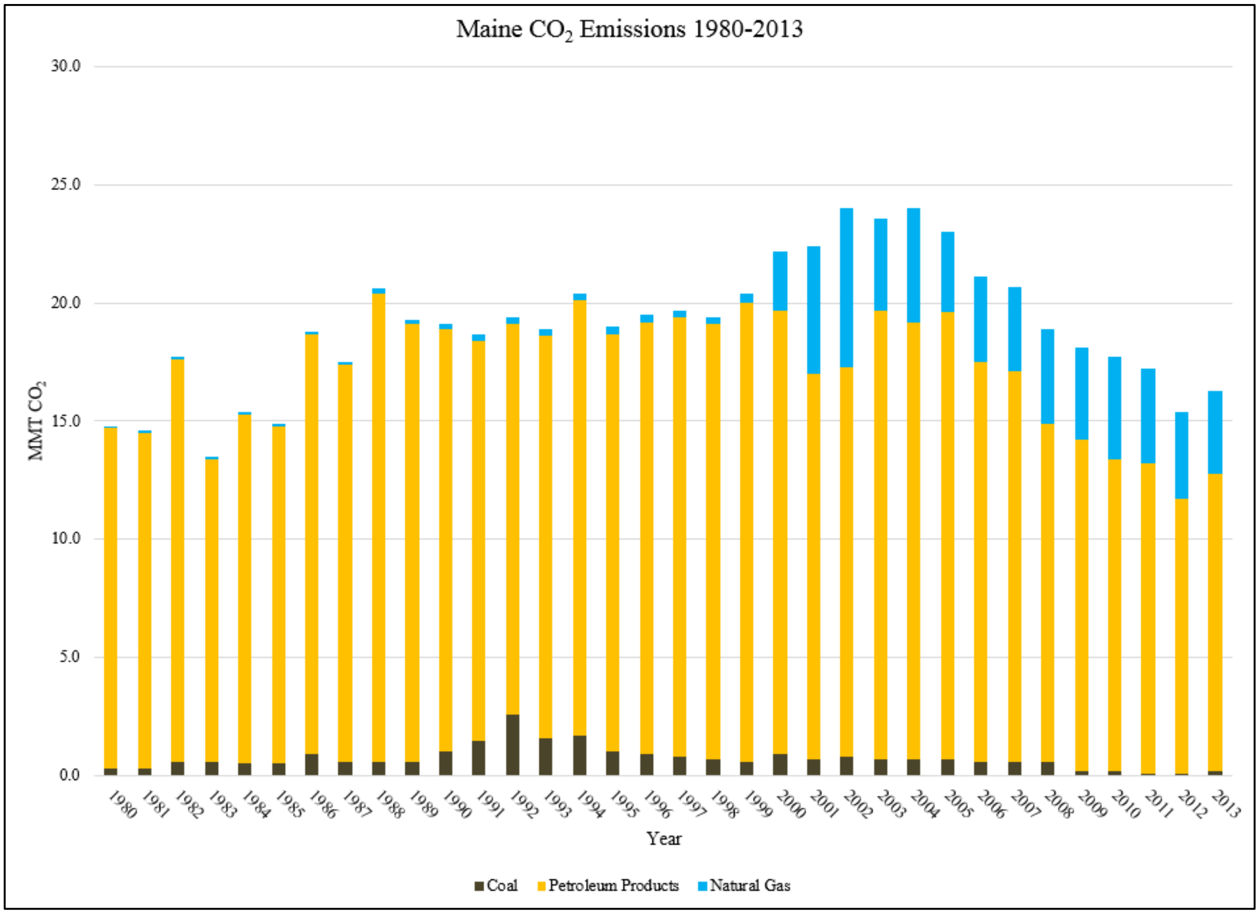
For the purposes of this PEIS, the EIA data on CO_2 emissions from fossil fuels will be used as the baseline metric to ensure consistency and comparability across the 50 states. However, if additional data sources on GHG emissions are available for a given state, including other GHGs such as CH_4, they will be described and cited.

Energy-related activities in Maine emitted a total of 16.2 MMT of CO_2 in 2013. Maine's CO_2 emissions increased from 1980 to a high of 23.9 MMT in 2004 from which they declined to their current level (EIA, 2015f). Increases and decreases in CO_2 emissions took place in all sectors and for all fuel types with the exception of natural gas, emissions from which have increased significantly since 1999 (EIA, 2015d). Energy use per capita in 2013 was the 15th in the U.S., and total CO_2 emissions were the 7th lowest in 2013 (EIA, 2015f).

Table 6.1.14-2: Maine CO_2 Emissions from Fossil Fuels by Fuel Type and Source, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	0.2	Residential	2.4
Petroleum Products	12.6	Commercial	1.6
Natural Gas	3.5	Industrial	2.4
		Transportation	8.4
		Electric Power	1.4
TOTAL	**16.2**	**TOTAL**	**16.2**

Source: (EIA, 2015d)



Source: (EIA, 2015d)

Figure 6.1.14-1: Maine CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Carbon dioxide constitutes the majority of Maine's GHG emissions, and is largely the product of fossil fuel combustion for the purpose of producing energy, mostly petroleum products used in the transportation sector and for home heat, and a growing proportion of natural gas for heat and hot water in residential and commercial buildings (EIA, 2014). Maine's natural gas consumption increased significantly after 2000 when the Portland Natural Gas Transmission System (PNGTS), a major extension of the northeast U.S. natural gas pipeline system into Maine was completed (EIA, 2015g).

Other major GHGs emitted in Maine are CH_4, hydrofluorocarbons (HFC) and, nitrous oxide (NOx). Sulfur hexafluoride and perfluorocarbons and sulfur hexafluoride were not included in Maine's inventory because emissions are normally very low and the state assumed that refrigerators and air conditioners are appropriately disposed (City of Portland, Maine, 2011).

Maine does not have an official state-level inventory, however its largest city, Portland, maintains its own GHG inventory, which was most recently updated in 2011. The inventory divides these emissions into two categories: indirect emissions and direct emissions. Direct emissions result from activities within the city and indirect emissions are GHG emissions that occur elsewhere to provide Portland's electricity. Total Portland GHG indirect and direct emissions were 1,142,797 CO_2 in 2010 (City of Portland, Maine, 2011).

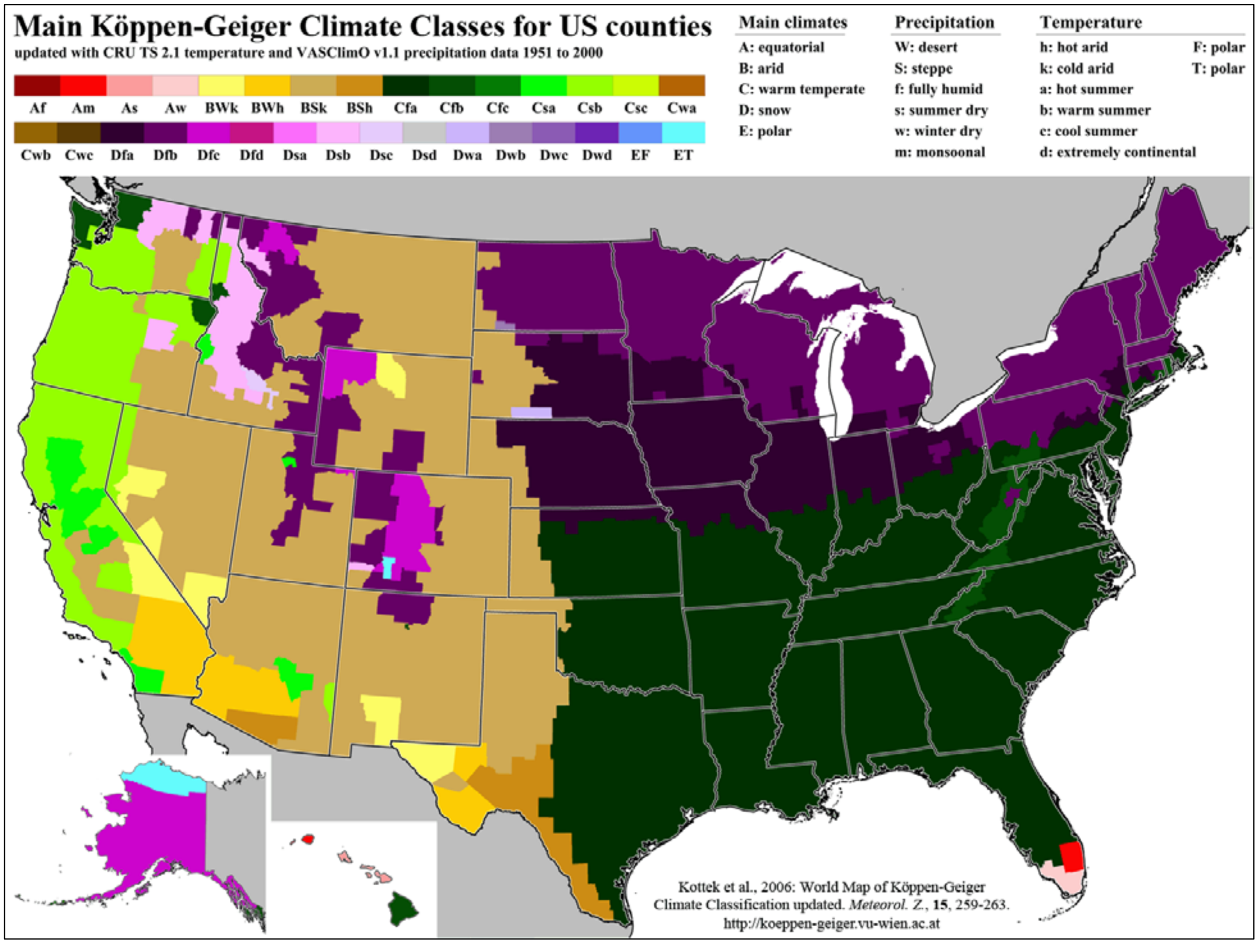
Overall, the highest direct CO_2 emissions in 2010 are from "stationary and mobile combustion of petroleum, natural gas, and waste" at 73 percent. (City of Portland, Maine, 2011). The majority of these fuels can be attributed to jet fuel, heavy fuel oil, and gasoline for vehicles. Fuel from airplanes and automobiles produced the most direct greenhouse gas emissions at 39 and 35 percent respectively. Since 2005, the transportation sector has seen reductions of approximately 37 percent which could be the result of new technology and fuel-efficient or alternative-fueled vehicles (City of Portland, Maine, 2011).

When looking at emissions by sector, providing electricity indirectly for residential, commercial and industrial sectors are the largest sources of GHG emissions in Portland. A majority of these emissions are the result of heating residences and buildings during long cold winters. The fuels evaluated that produce the most GHG emissions were jet fuel, gasoline, and heavy fuel oil. Overall, most of the population in Portland use fuel oil for heating their homes (City of Portland, Maine, 2011).

6.1.14.4 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 characteristics (NWS, 2011b).

The majority Maine falls into climate group Dfb (Figure 6.1.14-2). Climates classified as Dfb are "humid continental climates," with "humid, warm summers and severe winters" (NWS, 2011a). Dfb climates do not have a dry season. In (D) climates, the "average temperature of the warmest month is greater than 50 degrees Fahrenheit (°F), while the coldest month is less than negative 22 °F" (NWS, 2011a). Winter months in (D) climate zones are cold and severe with "snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NWS, 2011a). Although inland Maine is classified as Dfb, coastal Maine is classified as Cfa. Climates classified as Cfa are "mild, with no dry season and hot summers" (NWS, 2011a). In Cfa climates, average temperatures of the warmest months are over 72 °F and average temperatures of the coldest months are under 64 °F (NWS, 2011a). Cfa climates experience "year around rainfall," with high variability (NWS, 2011a). Maine has two sub-climate categories, which are described in the following paragraphs (NWS, 2011a).



Source: (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006)

Figure 6.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Cfa – The Köppen-Geiger climate classification system classifies coastal Maine, such as Portland, as Cfa. Cfa climates are generally warm, with humid summers and mild winters. Coastal Maine's secondary classification indicates year-round rainfall, but it is highly variable; thunderstorms are dominant during summer months (Figure 6.1.14-2). "During the winter, the main weather feature is the mid-latitude cyclone" (NWS, 2011a). Maine's 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 (NOAA, 2015g).

Dfb – The Köppen-Geiger climate classification system classifies inland Maine, including Bangor, Greenville, and Caribou, as Dfb. Climates classified as Dfb are characterized as humid, with warm summers and snowy winters (Figure 6.1.14-2) (NWS, 2011a). Maine's secondary classification indicates substantial precipitation during all seasons. Maine's tertiary classification indicates that at least four months out of the year have average temperatures above 50 °F (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006) (NWS, 2011a).

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

Air Temperature

Maine is composed of three climatological divisions: coastal, southern (interior), and northern (interior). Temperatures along coastal areas of Maine are largely dictated by the Atlantic Ocean, resulting in lower summer and higher winter temperatures than other interior regions of the state. The northern interior of Maine is the furthest from the Atlantic Ocean and has the highest topography. The mean annual temperature in Maine is 40.3 °F (NOAA, 2015g). The highest temperature to occur in Maine was on July 4, 1911 with a record high of 105 °F (SCEC, 2015). The coldest temperature to occur in Maine was on January 16, 2006 with a record low of negative 50 °F (SCEC, 2015). The annual average temperature in northern Maine is approximately 38.2 °F; in Maine's southern interior, the average temperature is approximately 42.5 °F; in Maine's coastal region, the average temperature is approximately 43.8 °F (NOAA, 2015h) (SCEC, 2015) (NOAA, 2015g).

The summer (June through August) of 2014 "was warmer than normal" with temperatures that "averaged 1 to 2.5 °F above normal" (NWS, 2015a). The most significant departures from average temperatures occurred in the far northeast corner of Maine (NWS, 2015a).

The following paragraphs describe Maine's temperature variations as they occur in the various climate classification zones:

Cfa – Portland, located along the southern coast of Maine is within the climate classification Cfa. The average annual mean temperature for this area is approximately 46.5 °F (NOAA, 2015h). Average annual temperatures during winter months are approximately 25.6 °F; temperatures during summer months are approximately 66.9 °F; temperatures during spring months are approximately 43.8 °F; and temperatures during autumn months are approximately 49.4 °F (NOAA, 2015h). During winter months in this climate zone, average minimum temperatures are approximately 16.8 °F, while average maximum temperatures during summer months are approximately 76.6 °F (NOAA, 2015h) (NOAA, 2015g).

Dfb – Bangor is located within Maine's southern interior, and within the climate classification Dfb. In Bangor, the average annual mean temperature is approximately 44.3 °F (NOAA, 2015h). January is generally the coldest month in Bangor, with temperatures dropping to below negative 30 °F (NOAA, 2015h). Most winter days are in "the low teens or single digits" (Robbins, 2012). Temperatures in February are slightly warmer, but this "slight increase in temperature makes conditions ripe for higher humidity and a greater chance of snow, making February the snowiest month in Bangor" (Robbins, 2012). July is Bangor's hottest month, "with an average high of 79

°F" (Robbins, 2012). August is Bangor's most humid month of the year, with temperatures regularly "in the mid- to upper-70s" (Robbins, 2012) (NOAA, 2015g) (NOAA, 2015h).

Greenville is located in central Maine, within the climate classification Dfb. In Greenville, the average annual mean temperature is approximately 41.0 °F (NOAA, 2015h). Average annual temperatures during winter months are approximately 16.2 °F; temperatures during summer months are approximately 63.9; temperatures during spring months are approximately 38.9 °F; and temperatures during autumn months are approximately 44.3 °F (NOAA, 2015h).

Caribou is located in northern Maine, within the climate classification Dfb. In Caribou, the average annual mean temperature is approximately 39.9 °F (NOAA, 2015h). Average annual temperatures during winter months are approximately 14.2 °F; temperatures during summer months are approximately 63.3 °F; temperatures during spring months are approximately 38.2 °F; and temperatures during autumn months are approximately 43.3 °F (NOAA, 2015h).

Precipitation

Maine is located along the Atlantic Ocean, with much of its coastline also along the Gulf of Maine and the Bay of Fundy. Weather systems from these sources are primarily responsible for transporting precipitation into Maine through circulation patterns and storm systems. Overall, Maine has an even distribution of precipitation throughout the year, with no distinct dry season. All areas of Maine "can expect 3 to 4 inches of precipitation every month of the year" (Jacobson, 2015). In addition to rainfall, Maine commonly experiences abundant snowfall throughout most of the state. On December 30, 1962, a 24-hour historic snowfall record was set, with 40 total inches of accumulation (SCEC, 2015) (Jacobson, 2015).

The following paragraphs describe Maine's precipitation events as they occur in the various climate classification zones:

Cfa **–** Although the annual precipitation is similar throughout Maine, the annual average precipitation in the coastal area is 44.3 inches (NOAA, 2015h). Portland, located along the southern coast of Maine is within the climate classification Cfa. Portland receives an average of 47.25 inches of total annual precipitation accumulation; an average of 10.65 inches during winter; an average of 10.54 inches during summer; an average of 12.57 inches during spring; and an average of 13.49 inches during autumn (NOAA, 2015h). Between October 20 and 21, 1996 a 24-hour precipitation record was also set with 13.32 inches of total accumulation (SCEC, 2015). In addition to rainfall, Portland receives abundant snowfall, with an average of 70 total inches of accumulation (NOAA, 2015g) (NOAA, 2015h) (Jacobson, 2015).

Dfb **–** Average annual precipitation amounts in Maine's interior vary slightly. Maine's northern interior receives an annual average of 41.1 inches, while Maine's southern interior receives an annual average of 43.1 inches (NOAA, 2015h). Bangor is located within Maine's southern interior, and within the climate classification Dfb. Bangor receives an average of 41.93 inches of total annual precipitation accumulation; an average of 8.89 inches during winter; an average of 10.20 inches during summer; an average of 10.64 inches during spring; and an average of 12.20 inches during summer (NOAA, 2015h) (Jacobson, 2015) (NOAA, 2015g).

Greenville is located in central Maine, within the climate classification Dfb. Greenville receives an average of 45.02 inches of total annual precipitation accumulation; an average of 9.41 inches during winter; an average of 12.60 inches during summer; an average of 10.46 inches during spring; and an average of 12.55 inches during autumn (NOAA, 2015g) (NOAA, 2015h).

Caribou is located in Maine's northern interior, within the climate classification Dfb. Caribou receives an average of 38.49 inches of total annual precipitation accumulation; an average of 8.19 inches during winter; an average of 11.32 inches during summer; an average of 8.50 inches during spring; and an average of 10.48 inches during autumn (NOAA, 2015h). As compared to coastal Portland, which receives an average of 70 inches of snowfall annually, Caribou receives an average of 112 inches annually. (Jacobson, 2015) (NOAA, 2015g) (NOAA, 2015h)

Sea Level

Maine has approximately 3,478 miles of coastline, with much of this shoreline at risk for damage from strong winds, heavy rainfall, flooding, and hurricanes (Bohlen, Stelk, Craig, & Gerber, 2013). Sea level in Portland, Maine "has "been rising at a rate of 1.8 ± 0.1mm/year since 1912" (Bohlen, Stelk, Craig, & Gerber, 2013). This increase in sea level rise is similar to the "global average sea level rise determined by the Intergovernmental Panel on Climate Change (IPCC)" (Bohlen, Stelk, Craig, & Gerber, 2013). Sea level rise in Maine will have significant impacts on the "inland migration of beaches, dunes, and salt marshes over the next century" (Bohlen, Stelk, Craig, & Gerber, 2013). In Portland, there are "four primary areas" that are deemed "as either being at risk of conflict between rising seas and existing developed areas, and/or including areas where [there is the] potential [for] marsh migration" (Bohlen, Stelk, Craig, & Gerber, 2013). The four identified areas are: Upper Fore River Area; Back Cove Area; Commercial Street Area; and East Deering Area (Bohlen, Stelk, Craig, & Gerber, 2013).

Severe Weather Events

In Maine, excessive and rapid snowmelt is one of the most common causes of flash flooding. Maine is also directly adjacent to the Atlantic Ocean, which makes the state highly vulnerable to coastal storms and tidal flooding. Additionally, Maine is susceptible to riverine flooding, which can occur due to ice floes or heavy rainfall. One of the most costly, widespread, and damaging floods to occur was in April 1987. This historic flood occurred in "central and southern Maine and affected the Saco, Androscoggin, Carrabassett, Kennebac, Piscataquis, and Penobscot Rivers" (NWS, 2015b). Between March 30 and April 2 "over 8 inches of rain [fell] in the foothills and mountains of Maine" (NWS, 2015b). Throughout this flooding event, most of the rainfall occurred over a "ripe snowpack that [already] had 6 to 10 inches of water in it" (NWS, 2015b). "Snow densities (the relative amount of water in the snow) ranged from .20 to .32 but are increasing slowly" (State of Maine, 2015). "A snowpack with densities above 0.33 is considered ripe… a ripe snowpack no longer has the ability to absorb rainfall and would tend to release water during a rain event" (State of Maine, 2015). This flooding event ultimately led to approximately $100 million in damages (1987 dollars) (NWS, 2015b).

Snowmelt alone does not typically lead to flooding (State of Maine, 2015). However, the likelihood of flooding increases in cases where excessive snowpack is carried into the spring, with the potential to be "triggered by warm temperatures and rain" (State of Maine, 2015). Stream flow and hazardous ice conditions gradually lead to "increasing stream flows in the spring" and are a "major factor in eroding ice cover" (State of Maine, 2015).

In April 2008, flooding along the St. John River due the combination of excessive and rapid snowmelt and 5 inches of rain on a "ripe snowpack" (NWS, 2015b). During the peak of this event, the "St. John River at Fort Kent crested at 30.17 feet" (NWS, 2015b). As a result, "more than 600 people were evacuated and 140 homes were flooded" (NWS, 2015b). Severe ice storm events have also occurred in Maine, most notably the Northeast Ice Storm in January 1998 (NOAA, 2000) (NWS, 2015b). This storm caused "extensive forestry losses," over $1.4 billion in damages, and 16 deaths (NOAA, 2000).

In comparison to other east coast states, hurricanes occur relatively infrequently in Maine (NOAA, 2015i). Between 1851 and 2014, only five Category 1 hurricanes and one Category 2 hurricane affected Maine (NOAA, 2015i). The Category 2 hurricane occurred in October 1869 (Saxby's Gale), while the five remaining Category 1 hurricanes occurred in September 1953 (Carol), September 1954 (Edna), September 1960 (Donna), September 1969 (Gerda), and September 1985 (Gloria) (NOAA, 2006). According to many hurricane experts, warmer waters in the Atlantic Ocean and Gulf of Mexico are contributing to more frequent and damaging hurricanes than in previous decades, with a record of 15 hurricanes occurring from the North Atlantic in 2005 (NYOEM, 2015).

The following paragraphs describe severe weather events as they occur in the various climate classification zones:

Cfa – Although hurricanes are not a regular occurrence in Maine, Portland, along with other low-lying coastal areas classified as a Cfa climate, are most susceptible to hurricane flooding and damage.

Dfb – Hurricanes are very uncommon in areas classified as Dfb climates. However, snowpack and snowmelt flooding, as described above, are both common throughout Maines low-lying (Dbf) climate zones.

6.1.15 Human Health and Safety

6.1.15.1 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 6.1.1, Infrastructure.

6.1.15.2 Specific Regulatory Considerations

Federal organizations, such as Occupational Safety and Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In Maine, this resource area is regulated by the Maine Department of Labor (MEDOL), and the Maine DEP. Maine is an OSHA "State Plan" state, covering state and local public sector employees. MEDOL is authorized by OSHA to administer the state program which oversees employee safety in all state and local government workplaces. The FirstNet Proposed Action and site work will not be performed by state or local employees. The involvement of state and local employees will be limited to emergency responders (e.g., police, fire, emergency medical transporters, etc.) and local government permitting authorities.

Federal laws relevant to protect occupational and public health and safety are summarized in Appendix C. Table 6.1.15-1 below summarizes the major Maine laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 6.1.15-1: Relevant Maine Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
MRS, Title 26, Chapter 6	Maine Department of Labor (MEDOL)	Workplace safety rules and regulations for public sector employees, enforceable by MEDOL.
MRS, Title 38, Chapter 2	Maine DEP	Requirement for Maine DEP to prevent, abatement, and control the pollution of the air, water, and land of the state.
MRS, Title 38, Chapter 13-B	Maine DEP	Requires adequate measures to ensure that the threats posed by uncontrolled hazardous substance sites are abated, cleaned up, or mitigated promptly.
MRS, Title 38, Chapter 13	Maine DEP	Implements an approach to waste management, which is based on reduction of waste, reuse, recycling, composting, and land disposal.
MRS, Title 35-A, Chapter 7-A	MEDOL	Regulations for ensuring overhead high-voltage line safety.

6.1.15.3 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 and possibly in confined spaces, while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring (OSHA, 2016a). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

Working from height, overhead work, and slip, trips, and 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, as well as to 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[122] 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 at 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

[122] 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.

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) presents risk of fire or explosion (Fiber Optic Association, 2010).

Noise – Sources of excess noise at telecommunication sites include heavy equipment operation, electrical power generators and other small engine equipment, air compressors, electrical and pneumatic power tools, and road vehicles, such a diesel engine work trucks. The cumulative noise environment has the potential to exceed the OSHA acceptable level of 85 decibels (dB) per 8-hour time weighted average (TWA) (see Section 6.1.13, Noise) (OSHA, 2002). Fugitive noise may emanate beyond the telecommunication work site and impact the public living in the vicinity, observing the work, or transiting through the area. (OSHA, 2016b)

Hazardous materials and hazardous waste – Work at telecommunication sites may require the storage and use of hazardous materials such as fuel sources for backup power generators and compressed gases used for welding and metal cutting (likely for 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)

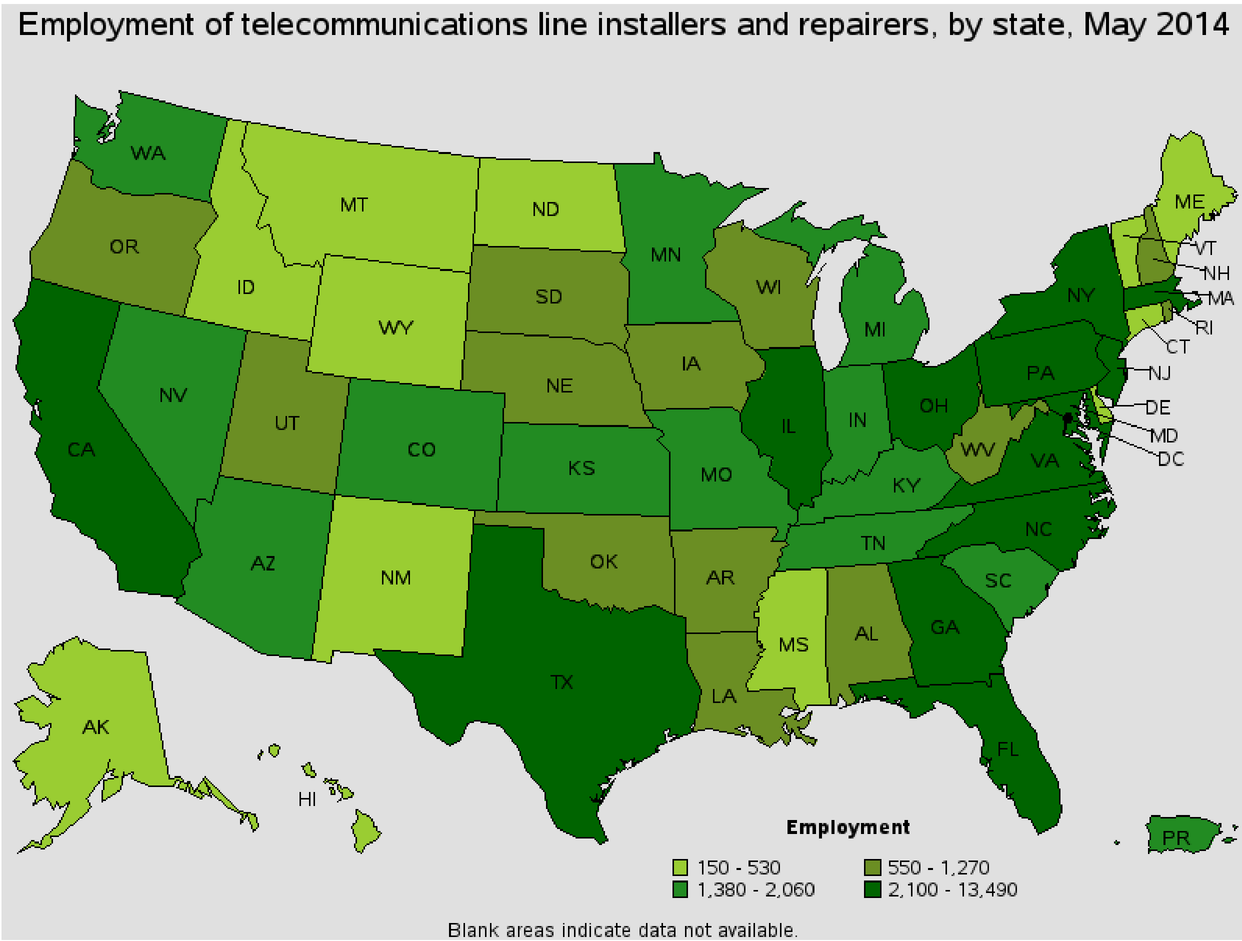
Aquatic environments – Installation of telecommunication lines may include laying, burying, or boring lines under waterways and wetlands, such as lakes, rivers, ponds, or streams. Workers responsible for these activities operate heavy equipment from soft shorelines, boats, barges, and other unstable surfaces. There is potential for equipment and personnel falls, as well as drowning in waterbodies. Wet work conditions also increase risks of electric shock and hypothermia. (OSHA, 2016b)

Outdoor elements – Weather conditions have the potential to quickly and drastically reduce safety, and increase hazards at telecommunication work sites. Excessive heat and cold conditions impact judgement, motor skills, hydration, and in extreme cases may lead to hyper- or hypothermia. Precipitation, such as rain, ice, and snow, can create slippery climbing conditions and wet or muddy ground conditions. Lightning strikes are risks to telecommunication workers climbing towers or working on top of buildings. (OSHA, 2016b)

Telecommunication Worker Occupational Health and Safety

As of May 2014, Maine employed 310 telecommunication line installers and repairers (U.S. Bureau of Labor Statistics, 2015c), and 880 telecommunication equipment installers and repairers (U.S. Bureau of Labor Statistics, 2015d). In 2012[123], the most recent year data are available, Maine reported 7.3 cases of nonfatal occupational injuries and illnesses in the telecommunications industry per 100 full-time workers (U.S. Bureau of Labor Statistics, 2012). By comparison, there were only 1.9 nonfatal occupational injury cases reported nationwide in both 2012 and 2013 per 100 full-time workers in the telecommunications industry (U.S. Bureau of Labor Statistics, 2013a).

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, and falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (U.S. Bureau of Labor Statistics, 2013b). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of total occupational fatalities (4,585 total). Maine has not reported any fatalities in the telecommunications industry.



Source: (U.S. Bureau of Labor Statistics, 2015c)

Figure 6.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

[123] 2013 BLS Survey of Occupational Injuries and Illnesses data for telecommunications industry not provided. However, parent Information industry (NAICS code 51) data for 2013 reported as too small to be displayed (U.S. Bureau of Labor Statistics, 2013c).

Public Health and Safety

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

6.1.15.4 Environmental Setting: Contaminated Properties at or near Telecommunication Sites

Existing and surrounding land uses, including landfills or redeveloped brownfields, near telecommunication sites have the potential to impact human health and safety. Furthermore, undocumented environmental practices of site occupants at telecommunication sites, prior to creation of environmental laws, could result in environmental contamination, affecting the quality of soil, sediments, groundwater, surface water, and air.

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[124] 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.

Maine's Uncontrolled Sites Program (USP), the state equivalent to the Superfund Program, was created to respond to threats to human health and the environment by abandoned hazardous waste sites. As of September 2015, Maine had 26 RCRA Corrective Action sites[125], 412 brownfield sites, and 13 proposed or final Superfund/NPL sites (USEPA, 2015i). Based on a September 2015 search of USEPA Cleanups in My Community (CIMC) database, there is one Superfund site in Maine where contamination had been detected at an unsafe level, or a reasonable human exposure risk exists (Callahan Mining site) (USEPA, 2015j).

Brownfield sites in Maine participate in the State Voluntary Remediation Action Program (VRAP). (Maine DEP, 2015l) One example of a state Brownfield Site is the Eastern Fine Paper Mill in Brewer, ME. The site was utilized as a lumber mill beginning in the late 1800's, and transitioned into paper and pulp manufacturing. Eastern Fine Paper filed for bankruptcy in 2004, and ceased operations. Maine DEP began initial site investigation in 2004, using USEPA Brownfields grant money. The USEPA and Maine DEP began an emergency removal of drums

[124] 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).

[125] Data gathered using USEPA's CIMC search on September 8, 2015, for all sites in Maine, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (USEPA, 2015i).

and totes of chemicals, fluorescent bulbs, mercury switches, PCB ballasts, and oils from the site. After the cleanup was completed, the City of Brewer was able negotiate the redevelopment of the site with a modular construction equipment manufacturer, the Eastern Manufacturing Facility. The development of this facility led to the creation of hundreds of skilled-labor jobs, while allowing for the reuse of 41 acres of otherwise abandoned, contaminated land. (USEPA, 2008)

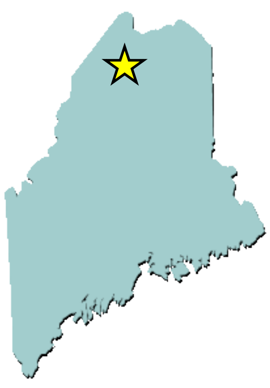
In addition to contaminated properties, certain industrial facilities are permitted to actively release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). As of September 2015, Maine had 83 TRI reporting facilities (USEPA, 2014e). According to the USEPA, Maine generated a total of 12,083,818 pounds of onsite and offsite disposal or other TRI releases in 2013, the most recent data available, largely from the paper industry. This accounted for 0.29 percent of total nationwide TRI releases, ranking Maine 36 out of 56 states/territories (USEPA, 2014e).

Spotlight on Maine Superfund Sites: Callahan Mining Corp.

The Callahan Mine site is a former zinc and copper mine near Brooksville, ME, discovered in 1880 and closed in 1972. Ore from the mine was milled using a "flotation" process, which used chemicals to separate the zinc and copper. The resulting waste products were discharged into an 11-acre tailings pond.

In 1975, studies by the Maine DEP and the USEPA identified mine waste consisting of PCB and metal contamination in the tailings pond. PCB concentrations found in the surface soil were determined to exceed "acceptable thresholds for contact by recreational or trespass visitor to the site." In 2011, cleanup activities began to address PCB human exposure, only to find that the extent of contamination was greater than anticipated. Remedial action was completed in 2013, removing arsenic, lead, and PCB-contaminated soil. (USEPA, 2015s)

Sites such as this present a risk to both the general public contacting contaminated soil, as well as telecommunication workers involved in installation activities that require soil disturbance.



Source: (De-Campos, Alfredo; Mamedov, Amrakh; Huang, Chi-hua, 2009)

Figure 6.1.15.4-1: Photo of Callahan Mine

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

The National Institute of Health (NIH), U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (NIH, 2015a). Figure 6.1.5-3 provides an overview of potentially hazardous sites in Maine.

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 6.1.3, Geology. As of May 2015, there were no high priority AMLs (sites posing health and safety hazards) in Maine (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2015).

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be situated at 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. According to U.S. Bureau of Labor Statistics data for 2013, there were no fatalities in Maine from occupational exposure to "harmful substances or environments." (U.S. Bureau of Labor Statistics, 2013d). By comparison, there were three reported fatalities in 2011 (U.S. Bureau of Labor Statistics, 2013e) and three preliminary[126] fatalities in 2014 (U.S. Bureau of Labor Statistics, 2015e) nationwide within the telecommunications industry, due to exposure to harmful substances or environments.

[126] BLS Census of Fatal Occupational Injuries data for 2014 is for preliminary reporting only. Final data is expected to be released in spring 2016 (U.S. Bureau of Labor Statistics, 2015f).

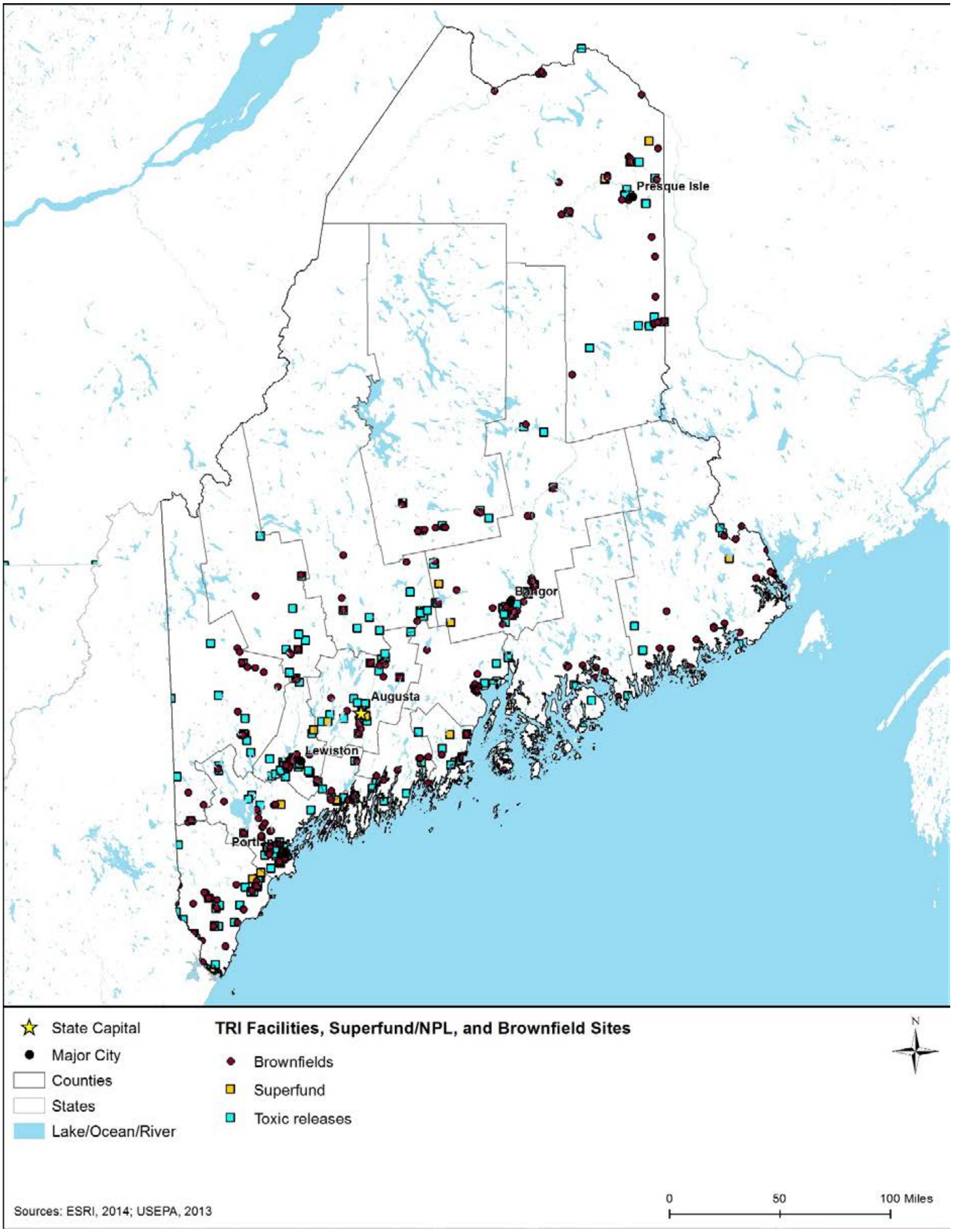


Figure 6.1.15-3: TOXMAP Superfund/NPL and TRI Facilities in Maine (2013)

Public Health and Safety

As described earlier, access to telecommunications sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunications 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 would then inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors. The Maine DHHS, Division of Environmental Health is responsible for collecting public health data resulting from exposure to environmental contamination. No data are available on from the Maine DHHS or federal sources that indicate public exposure to environmental hazards at contaminated sites, including telecommunications sites, resulted in public illnesses or fatalities (Maine DHHS, 2013).

6.1.15.5 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 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.). Hazardous chemicals and sanitary wastes often contaminate floodwaters, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003).

Spotlight on Maine Natural Disaster Sites: 1998 Ice Storm

In the case of emergency response, telecommunication workers could potentially encounter hazardous areas as a result of natural disasters. In January 1998, there was a major ice storm in northern New England, and disaster areas were declared in all 16 Maine counties. More than half the population lost power, radio communication systems were disrupted, and FEMA found $48 million in damages to government and infrastructure, $6.5 million in damages to individuals and businesses, and 6 fatalities (State of Maine, 2008).

Impacts to telecommunications infrastructure included insufficient auxiliary power for the extended periods (due to a lack of backup generators), blocked access to telecommunications sites due to downed trees, and cracked dish and cellular antennas. Eight telecommunications towers in Maine collapsed due to ice loads. The most significant of these was a 500-foot guyed tower maintained by the New Gloucester Fire Department, the top half of which broke off. (NOAA, 1998)

Source: (NOAA, 1998)

WEZQ Tower Collapse in East Eddington

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, and falls. During natural and manmade disasters, access to the telecommunication sites can be littered by debris.

Telecommunication Worker Occupational Health and Safety

Telecommunication workers are often called upon to provide support to natural and manmade disaster response efforts because of the critical need to restore and maintain telecommunication capabilities. The need to enter disaster areas as part of the initial recovery effort exposes telecommunication workers to elevated risks because chemical, biological, and physical hazards have not been fully assessed or cleared prior to telecommunication workers entering an area to complete repairs. Transportation infrastructure and utilities in the affected areas are often compromised and present unknown chemical and biologic hazards. Correspondingly, if telecommunication workers are injured during response operations that might be depending on damaged medical infrastructure and over-extended staff who are delivering care to victims of the initial incident. Currently, the MEDOL and U.S. Bureau of Labor do not report data specific to injuries or fatalities among telecommunication workers responding to natural or manmade disasters. However, the National Response Center (NRC) compiles incident reports related to occupational health and safety. Out of the 135 NRC-reported incidents for Maine in 2015 with known causes, only 10 were attributed to natural disaster (flooding or other natural phenomenon), while the majority (125) were attributed to manmade disasters (equipment failure and operator error) (U.S. Coast Guard, 2015). Routine operations such as this present unique, hazardous challenges to telecommunications workers 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 areas. 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, Maine experienced two weather related fatalities and one injury (NWS, 2015c).

6.2 Environmental Consequences

This section describes the potential environmental impacts, beneficial, or adverse, resulting from the Proposed Action and Alternatives. As this is a programmatic evaluation, site- and project-specific issues are not assessed. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Each resource area identifies the range of possible impacts on resources for the Proposed Action and Alternatives, include the No Action Alternative. The No Action provides a comparison to describe the effects of environmental resources of the existing conditions to the proposed Alternatives.

NEPA requires agencies to assess the potential direct and indirect impacts each alternative could have on the existing environment (as characterized earlier in this section). Direct impacts are those impacts that are caused by the Proposed Action and occur at the same time and place, such as soil disturbance. Indirect impacts are those impacts related to the Proposed Action but result from an intermediate step or process, such as changes in surface water quality because of soil erosion.

For each resource, the potential impact is assessed in terms of context of the action and the intensity of the potential impact, per CEQ regulations (40 CFR §1508.27). *Context* refers to the timing, duration, and where the impact could potentially occur (i.e., local vs. national; pristine vs. disturbed; common species vs. protected species). In terms of duration of potential impact, context is described as short or long term. *Intensity* refers to the magnitude or severity of the effect as either beneficial or adverse. Resource-specific significance rating criteria are provided at the beginning of each resource area section.

6.2.1 Infrastructure

6.2.1.1 Introduction

This section describes potential impacts to infrastructure in Maine 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.

6.2.1.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 6.2.1-1. 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.

6.2.1.3 Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would primarily occur during the construction phases of deployment. Depending on the exact site locations and placement of new assets in the field, temporary impacts on traffic congestion, railway use, airport or harbor operations, or use of other transportation corridors could occur if site locations were near or adjacent to roadways and other transportation corridors, requiring temporary closures (lane closures on roadways, for example). Coordination would be necessary with the relevant transportation authority (i.e., departments of transportation, airport authorities, railway companies, and harbormasters) to ensure proper coordination during deployment. The MaineDOT has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state, and would be the primary agency with which to coordinate

Based on the impact significance criteria presented in Table 6.2.1-1, 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 6.2.1-1, such potential negative and positive impacts would be less than significant.

Table 6.2.1-1: 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

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 capacity of local health, public safety, and emergency response services would experience less than significant impacts during construction or operation phases. 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 6.2.1-1, 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.[127] 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 6.2.1-1. Additionally, Maine has over 500 towers and First Net may be able to lease or leverage such assets for public safety use.

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

[127] 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.

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. The MPUC regulates electricity utilities and water utilities, while the DEP manages wastewater and solid waste; coordination with these state agencies may be necessary depending on the project-specific implementation plans.

6.2.1.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment, and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to infrastructure and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to infrastructure under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to infrastructure resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would have no impacts to infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any impacts to infrastructure resources, given that construction activities would occur on existing structures, would not be expected to interfere with existing equipment, and transportation capacity and safety, and access to emergency services would not be impacted.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to infrastructure as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of direct interface with existing infrastructure, most notably existing telecommunication infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to infrastructure include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs),[128] huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase, however, it is anticipated that this tie-in would cause less than significant impacts as the activity would be temporary and minor.
  - New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new or 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

[128] Points of Presence are connections or access points between two different networks, or different components of one network.

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 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 may require connection 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. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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 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. 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.

6.2.1.5 Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[129]

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to infrastructure 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

[129] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access roads or utility ROWs, 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. 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 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 6.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

6.2.2 Soils

6.2.2.1 Introduction

This section describes potential impacts to soil resources in Maine 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.

6.2.2.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 6.2.2-1. 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.

6.2.2.3 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 Maine 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 (USDA, 2000). Areas exist in Maine that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Aquents, Aquepts, Aquods, Fibrists, Folists, Hemists, Orthods, Saprists, and Udepts (see Section 6.1.2.4, Soil Suborders and Figure 6.1.2-2).

Table 6.2.2-1: 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 6.2.2-1, building of some of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. For the majority of projects, impacts to soils would be expected to be less than significant given the short-term and temporary duration of the activities.

To the extent practicable, FirstNet would attempt to minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 17).

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 6.2.2-1, 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 6.1.2.4, Soil Suborders). Heavy equipment can cause perceptible compaction and rutting of susceptible soils, particularly if BMPs and mitigation measures are not implemented.

Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 6.1.2.4, Soil Suborders). The most compaction susceptible soils in Maine are hydric soils with poor drainage conditions, which include Aquents, Aquepts, Aquods, Fibrists, Hemists, and Saprists. These soils are found in approximately 36 percent of Maine,[130] and found throughout the state (see Figure 6.1.2-2). 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 6.2.2-1, 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.

[130] 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.

6.2.2.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to soil resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to soil resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand-holes, pulling vaults, junction boxes, huts, and POP structures and would not impact soil resources because it would not produce perceptible changes to soil resources.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no impacts to soil resources. If physical access is required to light dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite phones, and video cameras, would not impact soil resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact soil resources, it is anticipated that this activity would have no impact on soil resources.

Activities with the Potential to Have Impacts

Implementation of the Preferred Alternatives could include potential deployment-related impacts to soil resources resulting from ground disturbance activities, including soil erosion, topsoil mixing, and soil compaction and rutting. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to soil resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in limited nearshore and inland bodies of water could potentially impact soil resources at and near the landings or facilities on shore to accept submarine cable. Soil erosion and topsoil mixing could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Perceptible soil compaction and rutting could potentially occur due to heavy equipment use during these activities depending on the duration of the construction activity.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of optical transmission equipment or centralized transmission equipment, including associated new utility poles, hand holes, pulling vault, junction box, hut, and POP structure installation, would require ground disturbance that could potentially impact soil resources. Potential impacts to soils resulting from soil erosion, topsoil mixing, soil compaction, and rutting are anticipated to be small-scale and short-term.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units, structural hardening, and physical security measures are needed, they may require ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way for deployment activities. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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.

6.2.2.5 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 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to soil resources associated with routine inspections of deployable assets, assuming that the same access roads used for deployment are also used for inspections. 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 6.1.2, Soils.

6.2.3 Geology

6.2.3.1 Introduction

This section describes potential impacts to Maine 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.

6.2.3.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 6.2.3-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to geology addressed in this section are presented as a range of possible impacts.

6.2.3.3 Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, landslides, and volcanic activity, and those that would be impacts from the project, such as land subsidence, mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Table 6.2.3-1: 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

Seismic Hazard

As discussed in Section 6.1.3, the majority of Maine is not at risk to significant earthquake events. As shown in Figure 6.1.3-5, south-central and northwestern Maine are at greatest risk to earthquakes throughout the state, though no earthquake over magnitude 6.0 on the Richter scale has been recorded in the state. 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. Based on the impact significance criteria presented in Table 6.2.3-1, seismic impacts would not be potentially significant if FirstNet's deployment locations in Maine would not be within high-risk earthquake hazard zones or active fault zones. Given the potential for minor to moderate earthquakes in parts of Maine, some amount of infrastructure be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Volcanic Activity

Volcanoes were considered but not analyzed for Maine, as they do not occur in Maine; therefore, volcanoes do not present a hazard to the state.

Landslides

As discussed in Section 6.1.3, portions of south-central and western Maine are at moderate to high risk of experiencing landslide events. Coastal bluffs in Maine are particularly susceptible to landslides. Based on the impact significance criteria presented in Table 6.2.3-1, potential impacts to landslides from deployment or operation of the Proposed Action would have less than significant impacts as it is likely that the project would attempt to avoid areas that are prone to landslides; however, landslide impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. 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. However, given that several of Maine's major cities, including Portland, Augusta, Lewiston, and Bangor, are in areas that experience landslides with moderate to high frequency, some amount of infrastructure could be subject to landslide hazards, in which case BMPs and mitigation measures (see below) could help avoid or minimize the potential impacts.

Land Subsidence

As discussed in Section 6.1.3.8, portions of Maine are vulnerable to land subsidence due to karst topography. Based on the impact significance criteria presented in Table 6.2.3-1, subsidence impacts could be potentially significant if FirstNet's deployment locations were within areas at high risk to karst topography, mine collapse, or inundation due to long-term land subsidence. Equipment that is exposed to land subsidence, such as sinkholes created by karst topography is subject to misalignment, alteration, or, in extreme cases, destruction. Significant long-term land subsidence, due to factors such as aquifer compaction, in coastal areas could lead to relative sea level rise[131] and inundation of equipment. All of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in known areas of karst topography or in areas that are subject to sea level rise. However, where infrastructure is subject to landslide hazards, BMPs and mitigation measures, as discussed in Chapter 17, could help avoid or minimize the potential impacts.

Mineral and Fossil Fuel Resource Impacts

Equipment deployment near mineral 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 6.2.3-1 impacts to mineral resources is unlikely as the Proposed Action could only be potentially significant if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral resources. To the extent practicable, FirstNet would avoid construction in areas where these resources exist.

Paleontological Resource Impacts

Equipment installation and construction activities that require ground disturbance could damage existing paleontological resources, which are both fragile and irreplaceable. Based on the impact significance criteria presented in Table 6.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 6.1.3.6, fossils are abundant in parts of Maine, especially in the area comprised of and surrounding Baxter State Park. 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 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 6.2.3-1, 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 the removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be

[131] Relative Sea Level Rise: "[Sea level rise that] includes the combined movement of both water and land. Even if sea level was constant, there could be changes in relative sea level. For example, a rising land surface would produce a relative fall in sea level, whereas a sinking land surface would produce a relative rise in sea level." (USGS, 2008)

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.

6.2.3.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

Implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities have the potential to be impacted by geologic hazards, some activities could result in potential impacts to geology, and other activities would have no impacts. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to geology under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. In most cases, there would be no impacts to geologic resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact geologic resources, it is anticipated that this activity would have no impact on geologic resources

Activities with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral and fuel resources and paleontological resources. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore 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 additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. However, where equipment is permanently installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact to the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could 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 as a result, these potential impacts are expected to be less than significant. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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 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, volcanic 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.

6.2.3.5 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, volcanic 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 and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to geologic resources (or from geologic hazards) as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 6.1.3, Geology.

6.2.4 Water Resources

6.2.4.1 Introduction

This section describes potential impacts to water resources in Maine 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.

6.2.4.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 6.2.4-1. 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 6.2.4-1: 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

6.2.4.3 Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the CWA requires states to assess and report on the quality of waters in their state. Section 303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

Most of Maine's rivers and streams, lakes, ponds, and reservoirs are in good condition; however all of the state's estuaries and bays, are impaired (see Table 6.1.4-2, Figure 6.1.4-2). Leading causes of impairment in Maine's estuaries and bays are from urban runoff; pollutants from municipal point source, non-point source, stormwater flow (USEPA, 2015a). Groundwater quality within the state is generally good (USGS, 1995).

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 USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs could reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA, 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 6.2.4-1, 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[132] 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 Maine 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.

Due to average thickness of most Maine aquifers, there is potential for groundwater contamination within a watershed or multiple watersheds. Thus, it is unlikely that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer, and based on the impact significance criteria presented in Table 6.2.4-1, 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 6.2.4-1, 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 likely occur during flood events with the exception of deployable technologies which may be

[132] 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, likely lasting no more than one season or water year,[133] or occur only during an emergency.

Examples of activities that would have less than significant impacts include:

- Construction of any structure in the 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.
- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures, as practicable and feasible, 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. Stormwater 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 stormwater drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage can cause increased erosion, changes in stormwater 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); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 6.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or subwatershed level would be considered less than significant.

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited stormwater runoff.
- Where stormwater is contained on site and does not flow to or impact surface waterbodies offsite on other properties.
- Activities designed so that the amount of stormwater generated before construction is the same as afterward.
- Activities designed using low impact development techniques for stormwater.

Since the proposed activities would not substantially alter drainage patterns in a way that would 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;

[133] 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, 2014h)

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 6.2.4-1. Projects that include minor consumptive use of surface water with less than significant impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) are likely to have less than significant impacts on flow alteration, on a watershed or subwatershed level. Examples of projects likely to have less than significant impacts include:

- Construction of any structure in a 100-year or 500-year floodplain that is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns off site or into surface water bodies that have not received that volume of stormwater 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

Over 60 percent of Maine residents rely on groundwater resources (Maine DEP, 2011b). Groundwater is an important natural resource used by industrial, commercial, agricultural, and residential uses for manufacturing, irrigation, and drinking water purposes. As described in Section 6.1.4.7, generally, the water quality of Maine’s aquifers is suitable for drinking and daily water needs (Maine DEP, 2011b). 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 the safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would be unlikely to cause any impacts to water quality due to the small volume of fuels anticipated to be stored on site and the likelihood that any spilled material would be cleaned up promptly. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater, generation.
- Storage of petroleum or chemical products when a leak goes undetected for some time.
- 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 under the Proposed Action should be less than significant since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would likely be short-term. The siting of deployment activities would likely attempt to avoid areas that would extract groundwater from potable groundwater sources in the area. According to Table 6.2.4-1, 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.

6.2.4.4 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 and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.
  - *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant:* Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the

existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.

- *New Build – Submarine Fiber Optic Plant:* The installation of cables in limited nearshore and inland bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to marine and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
- *New* Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
- *Collocation on Existing Aerial Fiber Optic Plant*: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
- *Installation of Optical Transmission or Centralized Transmission Equipment:* If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to water resources.

- Wireless Projects
  - *New Wireless Communication Towers:* Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - *Deployable Technologies:* Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require

land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in 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 could include water quality impacts. BMPs to help mitigate or reduce any potential impacts are described in Chapter 17.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along exiting roads and utility rights-of way. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected. 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.

6.2.4.5 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.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be less than significant impacts 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. 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. 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 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 6.1.4, Water Resources.

6.2.5 Wetlands

6.2.5.1 Introduction

This section describes potential impacts to wetlands in Maine 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.

6.2.5.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 6.2.5-1. 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.

6.2.5.3 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.

Table 6.2.5-1: Impact Significance Rating Criteria for Wetlands

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Direct wetland loss (fill or conversion to non-wetland)	Magnitude or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 404 of the CWA	Effect that is potentially significant, but with mitigation is less than significant	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No direct loss of wetlands.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	Effect that is potentially significant, but with mitigation is less than significant	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
degradation (spills or sedimentation)	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA
Indirect effects: [2] change in function(s)[3] 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

[1] "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

[2] 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

[3] 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.

Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

There are more than 2 million acres of palustrine and estuarine wetlands throughout Maine (USFWS, 2014a). Palustrine (freshwater) wetlands are found across the state, and estuarine/marine (tidal) wetlands are found along Maine's coastline with the Atlantic Ocean, as shown in Section 6.1.5, Figure 6.1.5-1 (Maine DEP, 1996).

Based on the impact significance criteria presented in Table 6.2.5-1, and given the temporary nature of most proposed activities, the deployment activities would most likely have less than significant direct impacts on wetlands.

In Maine, as discussed in Wetlands, Section 6.1.5.4, Wetlands, regulated high quality wetlands include "significant vernal pools." Found throughout Maine, vernal pools are a type of small, temporary wetland present in forested areas, though the pools themselves lack trees. The pools occur in shallow depressions that fill from spring or fall precipitation, and are usually dry by late summer or during droughts since they are not connected to a permanent water source. These small wetlands contribute to storage and filtration of surface water and help recharge aquifers. Vernal pools are fishless and are important breeding habitat for amphibians (salamanders and frogs), including wood frogs (*Rana sylvatica*), spotted (*Ambystoma maculatum*) and blue-spotted salamanders (*Ambystoma laterale*) (two types of mole salamanders) and fairy shrimp (*Artemia salina*). Significant vernal pools have not yet been comprehensively mapped in the state. Not all vernal pool habitats are considered "significant." In general, a vernal pool habitat is significant if it has a high habitat value, either because a state-listed threatened or endangered species, such as a spotted turtle (*Clemmys guttata*), or a rare species, such as a ribbon snake (*Thamnophis sauritis*), uses it to complete a critical part of its life history, or there is a notable abundance of specific wildlife, such as blue spotted salamander, wood frog, or fairy shrimp. (Maine DEP, 2009)

Maine's DEP regulates a 250 feet buffer area from around a Significant Vernal Pool habitat and requires consultation with the Agency prior to any activity in or on the area (Maine DEP, 2007c). High quality wetlands occur throughout the state, and are not comprehensively mapped; therefore, site-specific analysis would be required, in addition to BMPs and mitigation measures to avoid potentially significant impacts to wetlands.

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 stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 6.2.5-1, 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 Maine include:

- *Vegetation Clearing:* removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.
- *Ground Disturbance:* Increased amounts of stormwater runoff in wetlands 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 Hydrologic Changes (flooding or draining):* Greater frequency and duration of flooding can destroy native plant communities, as can depriving them of their water supply. Hydrologic changes can make a wetland more vulnerable to pollution. Increased water depths or flooding frequency can distribute pollutants more widely through a wetland. Sediment retention in wetlands is directly related to flow characteristics, including degree and pattern of channelization, flow velocities, and storm surges.
- *Direct Soil Changes:* Changes in soil chemistry can lead to degradation of wetlands that have a specific pH range and/or other parameter, such as the acidic conditions of Atlantic white cedar swamps and alkaline conditions of sea-level fens (which are high quality wetlands in Maine).
- *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:[134] change in function(s)[135] 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 Maine 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-demanding materials and reduce fecal coliform populations. These pollutants are often then buried by newer plant material, isolating them in the sediments.
- *Wildlife Habitat:* Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding 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.
- *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.

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[134] 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.

[135] 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.

According to the significance criteria defined in Table 6.2.5-1, 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 260,000 acres of wetlands in Maine 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 of the state with high quality wetlands, there could be potentially significant impacts at the project level that would be analyzed on a case-by-case basis. If avoidance were not possible, BMPs and mitigation measures would help to mitigate impacts.

6.2.5.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations could be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wetlands and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to wetlands under the conditions described below:

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant:* Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.

- Satellites and Other Technologies
  - *Satellite-Enabled Devices and Equipment:* It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satelites 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 additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - *Deployable Technologies:* Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, or blimps piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be less than significant 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.

6.2.5.5 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, 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. 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 wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 6.1.5, Wetlands.

6.2.6 Biological Resources

6.2.6.1 Introduction

This Chapter describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Maine 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.

6.2.6.2 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 6.2.6-1. As described in Section 6.2, 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 6.2.6.3, 6.2.6.4, and 6.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 6.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Maine.

6.2.6.3 Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in Maine 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 6.2.6-1, 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.

Table 6.2.6-1: 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: 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 Maine 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 Maine 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, that lead to mortality, disorientation, the avoidance or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with 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 disturbancesare 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.

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Regional or site specific effects observed within Maine 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
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.

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Regional effects observed Maine for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with 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.

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Regional effects observed within Maine 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
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.

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
	Geographic Extent	Regional impacts observed throughout Maine.		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

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, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case 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.

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[136], 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

[136] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to terrestrial vegetation because there would be no ground disturbance.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not impact terrestrial vegetation because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have no impact on terrestrial vegetation.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects 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 rights-of-way (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 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. 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 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 6.1.6.3, Terrestrial Vegetation.

6.2.6.4 Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates occurring in Maine and Maine'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 6.2.6-2, 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, 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 Maine. Maine's 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 (MDIFW, 2013b). 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 or minimize disturbance to bats.

<u>Marine Mammals</u>

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.

Entanglements from marine debris as well as ingestion of marine debris could result in injury or death to marine mammals. Marine debris is any manmade object discarded, disposed of, or abandoned that enters the marine environment. Entanglements from marine debris are not anticipated from FirstNet activities.

Many of the whale species known to occur offshore of Maine are also protected under the ESA. Environmental consequences pertaining to these whales are discussed in Section 6.2.6.6.

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 resting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state. Direct injury/mortality are not anticipated to be widespread or affect populations of bird populations due to the small-scale of likely FirstNet actions.

Direct mortality and injury to birds of Maine 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 further minimized. Additionally, potential impacts under MBTA and BGEPA can be addressed through BMPs and mitigation measures developed in consultation with USFWS.

Reptiles and Amphibians

The majority of Maine’s amphibian and reptile species are widely distributed throughout Maine. 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.

Three species of marine turtles – all listed as threatened or endangered under the ESA – occur in Maine’s offshore environment. Environmental consequences pertaining to these reptiles are discussed in Section 6.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Maine 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 in Maine that have experienced extensive land use changes from urbanization and agriculture. However, a large portion of the state is forested and remains 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 Maine's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Maine and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., black bear) by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals (e.g., bats, fisher, American marten) 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, as appropriate.

Marine Mammals

A number of seal species occur in the offshore areas of Maine. 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 Maine. 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.

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.

Loss of habitat or exclusions from these areas for seals and whales could be avoided or minimized by BMPs and mitigation measures, as appropriate (see Chapter 17). Environmental consequences pertaining to the endangered whales protected under the ESA are discussed in Section 6.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Birds

The direct removal of most bird nests is prohibited under the MBTA. The USFWS and Maine DEP 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, 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[137] 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 further minimize the potential impacts to birds from exclusion of resources.

Reptiles and Amphibians

Important habitats for Maine'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) could be implemented, as appropriate, to avoid or minimize the potential impacts.

[137]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.

Filling or draining of wetland breeding habitat (see Section 6.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to Maine's amphibian and reptile populations; site-specific analysis of potential wetland impacts would need to be conducted.[138]

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 6.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, 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

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 expected to be located offshore or in the oceanic environment, less than significant impacts to no impacts would be anticipated for marine mammals.

Birds

Repeated disturbance, especially during the breeding and nesting season, 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. The majority of FirstNet deployment activities would be short-

[138] See Section 6.2.5, Wetlands, for a discussion of BMPs for wetlands.

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, 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 Maine’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.[139] 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

Marine Mammals

Noise associated with the installation of cables in the near/offshore waters of coastal Maine 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[140]. It is clear that behavioral responses are strongly affected by the context of

[139] A location chosen by an animal for hibernation.

[140] 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)*

exposure and by the animal's experience, motivation, and conditioning. Marine mammals have the capacity to divert from sound sources during migration, and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. For example, as a group shorebirds migrating through Maine undertake some of the longest-distance migrations of all animals. Maine is located within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. Maine has 22 IBAs spread throughout the state that serve as important stopover areas for migratory birds (National Audubon Society, 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, but are generally expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of mole salamanders and the wood frog are known to seasonally migrate in Maine. These amphibians often travel by the hundreds on their migration pathway that often crosses roadways. Mole salamanders are typically found in burrows in the forest floor. Wood frogs use diverse vegetation types from grassy meadows to open forests. After they emerge from dormancy, wood frogs migrate up 900 feet to breeding pools, where they breed rapidly in early spring in permanent or ephemeral water (Homan, Atwood, Dunkle, & Karr, 2010). 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 impacts are expected to generally 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 Maine's terrestrial invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which 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 Maine.

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

Restricted access to important calving grounds has the potential to negatively affect body condition and reproductive success of marine mammals in Massachusetts. For example, the displacement of female seals from preferred pupping habitats due to deployment and operations may reduce fitness and survival of pups potentially affecting overall productivity, though activities are likely to be small-scale in nature and contribute only minimally to minor, short-term displacement, and BMPs and mitigation measures could 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, 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 Maine's wildlife are described below.

Terrestrial Mammals

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites, as these activities are temporary. Invasive species effects to terrestrial mammals could be minimized by following BMPs and mitigation measures in Chapter 17, as appropriate and feasible, 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 Maine, mute swans (*Cygnus olor*) can impact native waterfowl and wetland birds causing nest abandonment or impacts to rearing young due to their aggressive behavior. Further, this invasive bird can lead to declines in water quality from increased fecal coliform loading in the water, and declines in submerged aquatic vegetation that support native fish and other wildlife (Swift et al. 2013). 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 Maine; 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 in particular pose a large threat to Maine's 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 Maine and are known to cause irreversible damage to native forests (Forest Health & Monitoring Division, 2011). 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 are minimized following the BMPs and mitigation measures described below.

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.
  - 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 wildlife, marine mammals in particular (see Section 4.2.4, 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 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.

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 6.1.6.4, Terrestrial Wildlife.

6.2.6.5 Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Maine and Maine'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, 2012b).

Based on the impact significance criteria presented in Table 6.2.6-1, 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 but 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 6.2.4, 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 although these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers, therefore 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. 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 fisheries and aquatic habitats associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts 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 4.1.6.5, Fisheries and Aquatic Habitats.

6.2.6.6 Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Maine and Maine'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 6.2.6-2. 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.

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 6.2.6-2, 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 and amphibians, fish, invertebrates, and plants with known occurrence in Maine are described below.

Table 6.2.6-2: 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.	

Terrestrial 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 these species as well, such as decreased availability for insect prey (Dodd, L.E. et al., 2011). The Canada Lynx could experience injury or mortality if projects were to occur within boreal forests where they are known to occur (USFWS 2007). 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.

Birds

Three federally listed birds, the piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), and the roseate tern (*Sterna dougallii)* are known to occur in Maine. 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 if nests are either disturbed or destroyed during land clearing, excavation and trenching, and other ground disturbing activities. If proposed project sites were unable to avoid sensitive areas, 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.

Fish

The Atlantic salmon is found in the Gulf of Maine. Direct mortality or injury to the endangered shortnose sturgeon species could occur from vessel/boat strikes or entanglements resulting from the Proposed Action are unlikely as the majority of FirstNet deployment projects would not occur in the 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.

Reptiles and Amphibians

Three federally listed sea turtles are also known to occur in the coastal area and offshore environment of Maine. None of these sea turtles nest in Maine. Direct mortality or injury is unlikely as the majority of 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

There are no listed invertebrates in Maine.

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, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Maine are described below.

Terrestrial Mammals

Reproductive effects to the federally listed Northern long-eared bat could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) and bats were present (USFWS 2015a). Noise, light, and other human disturbances associated with the Proposed Action could adversely affect federally listed terrestrial mammals within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. 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 Maine on sandy beaches and coastlines. The majority of FirstNet deployment activities would not occur on beaches; therefore, impacts to these bird species are not anticipated. Noise, light, or human disturbance within nesting areas could cause red knots 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

Maine does not have any federally listed terrestrial reptiles and amphibians. The three federally listed sea turtles found in the offshore areas of Maine are migrants. Consequently, no long-term reproductive effects to federally listed sea turtles are expected as a result of the Proposed Action.

Fish

Deployment activities in the upstream portions of the rivers of Maine resulting in increased disturbance (e.g., humans, noise), especially during spawning activity, and changes in water quality and quantity can cause stress resulting in lower productivity (see Section 6.2.4, Water Resources, for a discussion of potential impacts to water resources. Impacts to reproduction for the endangered Atlantic salmon is unlikely as the majority of 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

There are no listed invertebrates in Maine.

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 and amphibians, fish, invertebrates, and plants with known occurrence in Maine are described below.

Mammals

Direct mortality or injury to federally listed bats 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). Projects occurring in boreal forests where the Canada Lynx may experience some temporary, short-term disruptions. 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

Three federally listed sea turtles are also known to occur in the coastal area and offshore environment of Maine. None of these sea turtles nest in Maine. Behavioral changes are unlikely as the majority of 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.

Fish

Changes in water quality as a result of ground disturbing activities could impact food sources for the Atlantic salmon. Further, increased human disturbance, noise, and vessel traffic could cause stress to shortnose sturgeon causing them to abandon spawning locations or alter migration patterns. Behavioral changes to the Atlantic salmon sturgeon are unlikely as the majority of 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

There are no listed invertebrates in Maine.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary for geographic extent. 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. The Canada Lynx and Atlantic salmon have designated critical habitat in the state.

Terrestrial Mammals

Critical habitat for the Canada lynx occurs in Maine, throughout the northern half of the state (Figure 6.1.6-3). Due to the small-scale nature of FirstNet activities, and the large geographic area designated as critical habitat, it is unlikely that this species would be impacted from the loss or degradation of designated critical habitat. BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Birds

No critical habitat has been designated for bird populations that are known to occur in Maine; 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 Maine. 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.

Fish

Critical habitat for the Atlantic salmon occurs in Maine, throughout the southern half of the state. Due to the small-scale nature of FirstNet activities, and the large geographic area designated as critical habitat, it is unlikely that this species would be impacted from the loss or degradation of designated critical habitat. BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

No designated critical habitat occurs for terrestrial or aquatic invertebrates in Maine. 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 Maine. 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 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 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 Effect

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no effect 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 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, 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 6.2.4, 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. 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 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 6.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

6.2.7 Land Use, Recreation, and Airspace

6.2.7.1 Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Maine 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.

6.2.7.2 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 6.2.7-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to land use, recreation, and airspace resources addressed in this section are presented as a range of possible impacts.

Table 6.2.7-1: 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

6.2.7.3 Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of 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 6.2.7-1, less than significant impacts would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the 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 6.2.7-1, 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 6.2.7-1, 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 6.2.7-1, 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 6.2.7-1, 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 be likely to impact airspace resources.

6.2.7.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure, and the specific deployment requirements, some activities would result in potential impacts to land use, recreation, and airspace resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts 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.
    - 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 Section 6.1.7.5, Obstructions to Airspace Considerations).
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: See *Activities 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 Section 6.1.7.5, Obstructions to Airspace Considerations).
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: See Activities 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 because they would not change pole height, and therefore 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 Navigable Airspace* (see Section 6.10.5.3 Obstructions to Airspace Considerations).

- 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 Section 6.1.7.5 Obstructions to Airspace Considerations).

- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
    - Land Use: See Activities 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 Section 6.1.7.5, Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See *Activities 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 Aboveground Level (AGL) or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 6.1.7.5, Obstructions to Airspace Considerations.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed and 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.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) rights-of-way or easements and the potential construction of access roads.
    - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed 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.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: No impacts are anticipated – see previous section.

- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
  - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
  - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.
  - Airspace: No impacts are anticipated – see previous section.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.
  - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
  - Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
  - Airspace: No impacts are anticipated – see previous section.

- Wireless Projects
  - New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.
    - Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet AGL or meets the other criteria listed in Section 6.1.7.5, Obstructions to Airspace Considerations. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight

patterns of an airport if the aerial fiber optic plant is located in proximity to one of Maine's airports.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
  - Land Use: No impacts are anticipated – see previous section.
  - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
  - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airports or air navigation facilities.

- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: No impacts are anticipated – see previous section.
    - Airspace: Implementation of deployable aerial communications architecture could result in temporary or intermittent impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near Maine airports (See obstruction criteria in Section 6.1.7.5, 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. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: No impacts are anticipated – see previous section
    - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.

- Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace 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. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections. 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 6.2.8, 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.

6.2.7.5 Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use. 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. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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/or airborne deployable vehicles and potentially 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 6.1.7, Land Use, Recreation, and Airspace.

6.2.8 Visual Resources

6.2.8.1 Introduction

This section describes potential impacts to visual resources in Maine 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.

6.2.8.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 6.2.8-1. 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.

6.2.8.3 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 Maine, residents and visitors travel to many national and state parks, such as Acadia National Park, to view its rugged coast and rocky beaches. If lands considered visually significant or scenic were subject to vegetation loss or removal, short- or long-term effects to viewsheds or scenic resources could occur. Bare ground or interruption of a landscape due to vegetation removal could be considered an adverse change in the aesthetic character of scenic resources or viewsheds. New towers or structures constructed within scenic areas could disrupt the perceived aesthetic character or scenery of an area. Maine's Natural Resources Protection Act of 1988 requires that activities not "unreasonably interfere with existing scenic, aesthetic, recreational, or navigational uses." In

Maine, construction activities requiring a permit need to prepare an initial assessment form with accompanying site and surrounding area photographs. The Maine DEP reviews each form to determine if a scenic resource is present to determine if the project is acceptable or requires mitigation (Maine DEP, 2007b). 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.

Table 6.2.8-1: 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

Based on the impact significance criteria presented in Table 6.2.8-1, 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 6.2.8-1, 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.

6.2.8.4 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 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 additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lightning.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant due to the temporary and small-scale 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.

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. 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.

6.2.8.5 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. 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 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 6.1.8, Visual Resources.

6.2.9 Socioeconomics

6.2.9.1 Introduction

This section describes potential impacts to socioeconomics in Maine 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.

6.2.9.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 6.2.9-1. 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 6.2.9-1: 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

6.2.9.3 Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate
- Economic Benefits or Adverse Impacts related to Changes in Spending, Income, Industries, and Public Revenues
- Impacts to Employment
- Changes in Population Number or Composition

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values below typical market values due to below average public safety communication services. Improved services would reduce response times and improve responses (provide a better fit of the response to the need). These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Affected Environment, property values vary considerably across Maine. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $320,000 in the Maine portion of the Portsmouth area, to around $130,000 in the Augusta and Waterville areas. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to approximately 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 pending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary 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 Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across Maine. The average unemployment rate in 2014 was 5.7 percent. County-level unemployment rates were lowest in the counties that include Portland, Brunswick, and Rockland, and highest in the large and sparsely populated counties of the northern and eastern portions 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 6.2.9-1 because they would not constitute a "high level of job creation *at the state or territory level.*"

Changes in Population Number or Composition

In general, changes in population numbers occur when employment increases or decreases to a degree that affects the decisions of workers on where they can find employment; that is, when workers and their families move to or leave an area because of employment opportunities or the lack thereof. As noted above, deployment and operation of the NPSBN is likely to generate new employment opportunities (directly and indirectly), but employment changes would not be large enough in any state to be considered significant. Therefore, it is highly unlikely that the NPSBN would lead to significant changes in population numbers according to the significance criteria table above. Further, it is unlikely that the NPSBN would lead to any measurable changes in population numbers in any geographic areas, with the possible exception of cities where companies that win major NPSBN contracts establish centers for NPSBN deployment and operation activities. Smaller numbers of employees in any area would not produce measurable population changes because population is always in flux due to births, deaths, and in-migration and out-migration for other reasons.

Population composition refers to age, gender, race, ethnicity, and other characteristics of the individuals making up a population. Given the low potential for changes to population numbers, it is highly unlikely that the NPSBN would lead to any changes in population composition.

6.2.9.4 Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 6.2.9-1.

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. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate
- Changes to Spending, Income, Industries, and Public Revenues
- Impacts to Employment
- Changes in Population Number or Composition

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment through existing or new boxes or huts would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

  - New Build – Aerial Fiber Optic Plant: Pole/structure installation would have the following types of socioeconomic impacts:

    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Wireless Projects

  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:

    - Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus the impacts would be less than significant.

    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.

    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
    - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:
        - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant.
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

In general, the abovementioned activities would have less than significant beneficial socioeconomic impacts. 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.

The discussion above characterized the impacts of each type of activity. The socioeconomic impacts of all activities considered together would also be less than significant. Even when considered together, the impacts would be very small relative to the total economic activity and property value of any region or the state. In addition, with the possible exception of property values, all deployment impacts would be limited to the construction phase.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. As with deployment activities, all operational activities would have socioeconomic impacts, because all represent economic activity. All operational activities would be conducted by public or private sector employees, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity, and not significant across the entire state, they are measurable socioeconomic impacts.

Potential socioeconomic impacts would primarily be beneficial, and generally of these types:

- Changes to Spending, Income, Industries, and Public Revenues – Operational activities would require expenditures, which then generate business income and employee wages, and may result in new public sector revenues such as taxes on sales and income. All such effects would be small in scale relative to the regional and state economy; their impacts would be less than significant.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would be less than significant as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within Maine. 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.

6.2.9.5 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 0, Socioeconomics.

6.2.10 Environmental Justice

6.2.10.1 Introduction

This section describes potential impacts to environmental justice in Maine 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.

6.2.10.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 6.2.10-1. 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 6.2.10-1: Impact Significance Rating Criteria for Environmental Justice

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Effects associated with other resource areas (e. g., human health and safety, cultural resources, socioeconomics) that have a disproportionately high and adverse impact on low-income populations and minority populations	Magnitude or Intensity	Direct and disproportionately high and adverse effects on environmental justice communities (as defined by EO 12898) that cannot be fully mitigated	Effect that is potentially significant, but with mitigation is less than significant	Direct effects on environmental justice communities (as defined by EO 12898) that are not disproportionately high and adverse, and therefore do not require mitigation	No direct effects on environmental justice communities, as defined by EO 12898
	Geographic Extent	Effects realized within counties at the Census Block Group level		Effects realized within counties at the Census Block Group level	Effects realized within counties at the Census Block Group level
	Duration or Frequency	Persists during the life of the project		Persists for as long as the entire construction phase or a portion of the operations phase	NA

NA = Not Applicable

6.2.10.3 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 (Section 6.2.9).

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deploys projects, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this PEIS. The areas shown in the environmental justice screening map of Affected Environment (Section 6.1.10.4) as having moderate potential or high potential for environmental justice populations would particularly warrant further screening. As discussed in Affected Environment (Section 6.1.10.3), Environmental Setting: Minority and Low-Income Populations, Maine's population has lower percentages of minorities than the region or the nation, and a rate of poverty that is higher than that of the region and lower than that of the region. Maine's distribution of areas with High Potential for environmental justice populations is fairly even across much of the state (particularly across the southern portion of the state), and occurs both within and outside of the 10 largest population concentrations. However, in the majority of the more sparsely populated areas in the northwestern and northern portions of Maine, environmental justice potential is mostly categorized as moderate or low. Further analysis using the data developed for the screening analysis in Section 6.1.10.4 may be useful. In addition, USEPA's EJSCREEN tool and USEPA's lists of environmental justice grant and cooperative agreement recipients may help identify local environmental justice populations (USEPA, 2015e; USEPA, 2014f).

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.

6.2.10.4 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, 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

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.

6.2.10.5 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 6.1.10, Environmental Justice.

6.2.11 Cultural Resources

6.2.11.1 Introduction

This section describes potential impacts to cultural resources in Maine 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.

6.2.11.2 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 6.2.11-1. As described in Section 0, 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.

6.2.11.3 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 6.2.11-1, direct deployment impacts could be potentially significant if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given that archaeological sites and historic properties are present throughout Maine, some deployment activities may be in these same areas, in which case BMPs (see Chapter 17) would help avoid or minimize the potential impacts.

Table 6.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect[1]**	**Effect, but Not Adverse**	**No Effect**
Physical damage to and/or destruction of historic properties[2]	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[1]	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

[1] 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.

[2] 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.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of potentially significant impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alter historic architectural features. 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.

6.2.11.4 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 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to cultural resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to cultural. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles

and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water could impact cultural resources, as coastal areas of Maine have the potential to contain prehistoric 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 (Maine has a large number of mills located along its rivers), 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, such as York, that have larger numbers 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 These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment site. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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. 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.

6.2.11.5 Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse effects to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be no effects to cultural resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur, however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. 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 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 6.1.11, Cultural Resources.

6.2.12 Air Quality

6.2.12.1 Introduction

This section describes potential impacts to Maine'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.

6.2.12.2 Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Maine's air quality were evaluated using the significance criteria presented in Table 6.2.12-1. 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 Maine's air quality addressed in this section are presented as a range of possible impacts.

6.2.12.3 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. Although unlikely, the emissions of criteria pollutants could impair the air quality of the region and potentially affect human health. Potential impacts to air quality from emissions may occur in areas where the current air quality exceeds, or has a history of exceeding, one or more NAAQS. Areas exist in Maine that are in maintenance or nonattainment for one or more criteria pollutants, particularly, ozone is a statewide issue (see Section 6.1.12, Air Quality). The counties of Androscoggin, Cumberland, Hancock, Knox, Lincoln, Sagadahoc, Waldo, and York all are maintenance areas for Ozone; the county of Aroostook is a maintenance area for particulate matter; and the county of Penobscot is a maintenance area for SOx.

Based on the significance criteria presented in Table 6.2.12-1, air emission impacts could be potentially significant if:

- The majority of FirstNet's buildout/deployment locations were in these sensitive areas; or
- A large number of emission sources were deployed/operated long-term in the same area.

To the extent practicable, FirstNet would attempt to minimize air emissions, particularly in nonattainment and maintenance areas. However, given maintenance areas are present throughout Maine, 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 6.2.12-1: Impact Significance Rating Criteria for Maine

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

6.2.12.4 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. 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.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to air quality under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points, however this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create no new sources of emissions.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to no impact on ambient air quality concentrations.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have no impact on those resources.

Activities with 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 and air pollutant emissions. It is expected that such impacts would be less than significant due to the shorter duration and localized nature of the activities. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in fugitive dust and products of combustion from the use of vehicles and heavy equipment.
  - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment could result in products of combustion from the use of vehicles and machinery, as well as fugitive dust emissions from site preparation.
  - Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in products of combustion from the use of vehicles and heavy equipment, as well as fugitive dust from site preparation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could generate products of combustion from vessels used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.
- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or

access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.

- Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If additional power units, structural hardening, and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
- Deployable Technologies: The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be less than significant 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. 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.

6.2.12.5 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. 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 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.

6.2.13 Noise

6.2.13.1 Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and alternatives in Maine. 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.

6.2.13.2 Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 6.2.13-1. 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 Maine addressed in this section are presented as a range of possible impacts.

6.2.13.3 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 6.2.13-1, 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 6.2.13-1: 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

6.2.13.4 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 described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no noise impacts under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
    - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in high noise levels from the use of heavy equipment and machinery.
  - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment would be short-term and could result in increased noise levels from the use of vehicles and machinery.
  - Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in noise levels from the use of heavy equipment and machinery.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise levels if the activity required the use of heavy equipment for grading or other purposes.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could generate noise if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.
- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or

access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.

- Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
- Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, 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). Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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. 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.

6.2.13.5 Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations and the duration of deployment. The potential noise impacts are as follows:

Deployment Impacts

Implementing deployable technologies could result in noise from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise levels. Several vehicles traveling together could also create short-term noise impacts on residences or other noise-sensitive receptors as they pass by. With the exception of balloons, the deployment of aerial technology is anticipated to generate noise during all phases of flight. Aerial technologies would have the highest level of noise impact if they are required to fly above residential areas, areas with a high concentration of noise-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, 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. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise impacts could result as explained above.

Operational impacts from aerial technologies would include repeated flyovers by UAS vehicles while they are needed in the area. This could generate less than significant short-term impacts on any residential areas or other noise-sensitive receptors under the flight path of these vehicles. However, once these operations cease, noise levels would quickly return to baseline levels. 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.

6.2.14 Climate Change

6.2.14.1 Introduction

This section describes potential impacts to climate and climate change-vulnerable FirstNet installations and infrastructure in Maine 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.

6.2.14.2 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 6.2.14-1. 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, 2015k), 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 6.2.14-1: 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

6.2.14.3 Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. 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 6.2.14-1 and Figure 6.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Connecticut from a 1969 to1971 baseline.

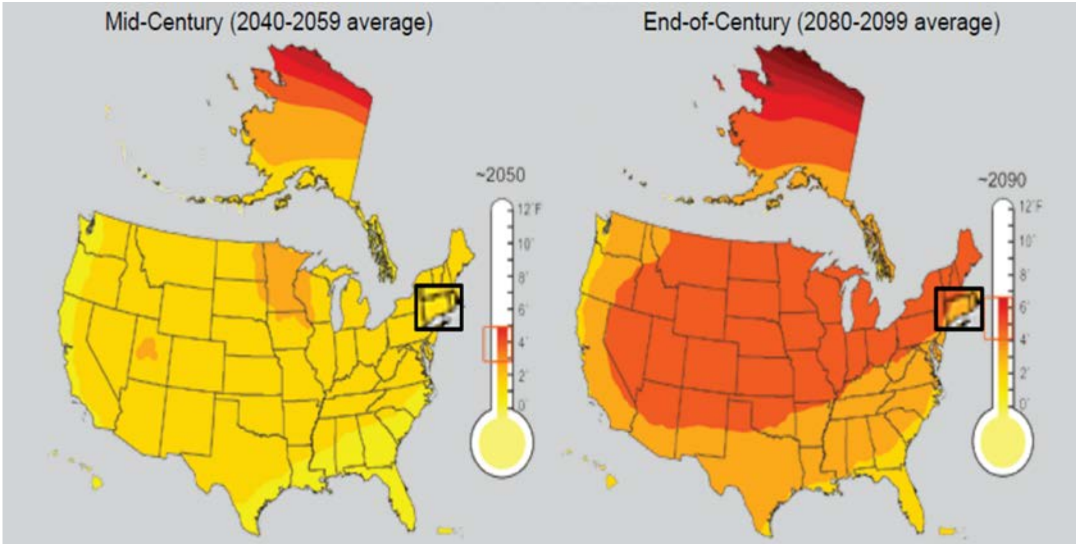
Cfa – Figure 6.2.14-1 shows that by mid-century (2040 to 2059) temperatures in the entire state of Maine under a low emissions scenario will increase by approximately 4 °F, and under a low emissions scenario for the period (2080 to 2099) temperatures in the Cfa region will increase by approximately 5° F (USGCRP, 2009).

Figure 6.2.14-2 shows that by mid-century temperatures will increase by approximately 5° F in the entire state of Maine under a high emissions scenario. By the end of the century (2080 to 2099) temperatures in the Cfa region of Maine under a high-emissions scenario will increase by approximately 8 °F (USGCRP, 2009).

Dfa – Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Cfa region under both low and high emissions scenarios (USGCRP, 2009).

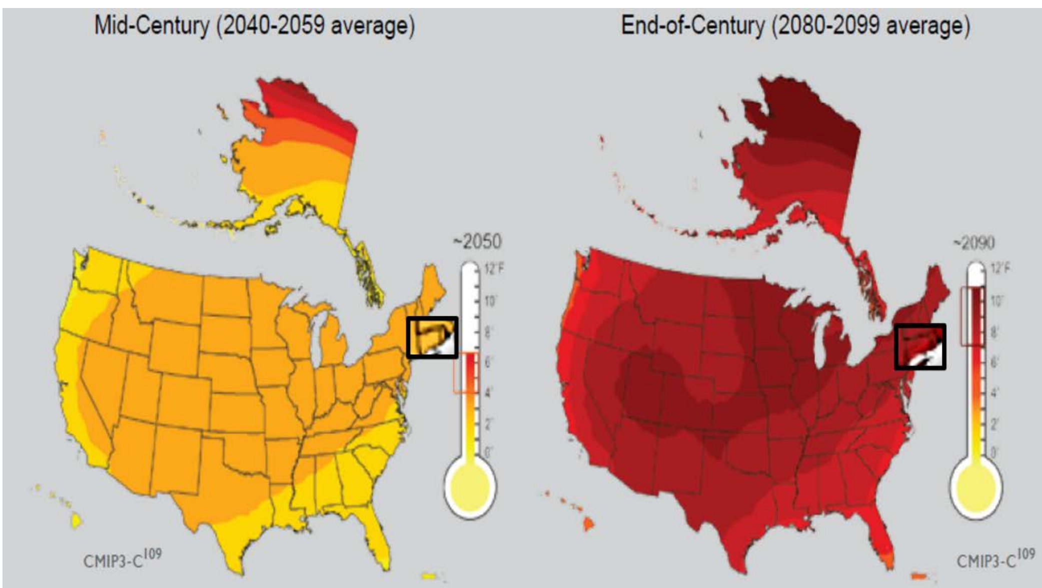
Dfb – Temperatures in this region under a low emissions scenario are expected to increase by mid-century (2040 to 2059) at the same rate as the Cfa and Dfa regions. The majority of the Dfb region's temperature is expected to rise at the same rate as Cfa and Dfa in a low emissions scenario by the end of the century. However, temperatures in the northwestern most portion of the state may increase up to 6° F by the end of the century (USGCRP, 2009).

Temperatures in the Dfb region under a high emissions scenario for the period (2040 to 2059) temperatures will increase at the same rate as the Cfa and Dfa regions. Temperatures in the Dfb region under a high emissions scenario for the period (2080 – 2099) will increase by approximately 9° F (USGCRP, 2009).



Source: (USGCRP, 2009)

Figure 6.2.14-1: Maine Low Emission Scenario Projected Temperature Change



Source: (USGCRP, 2009)

Figure 6.2.14-2: Maine High Emission Scenario Projected Temperature Change

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 6.2.14-3 and Figure 6.2.14-4 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 6.2.14-3 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050 (USGCRP, 2014b).

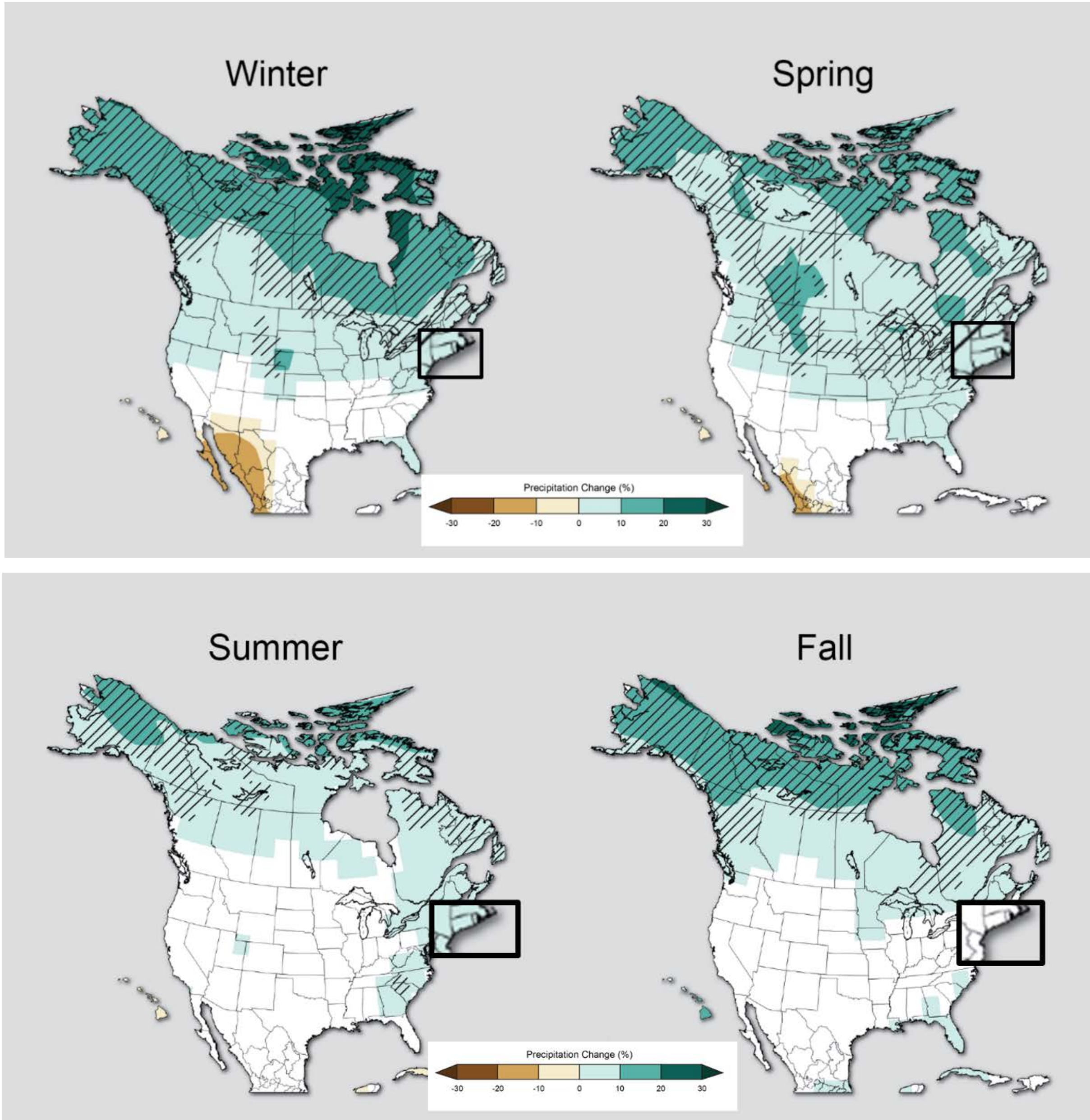
Figure 6.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. Continued increases in emissions would lead to large reductions in spring precipitation in the northeast. Note: white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability (USGCRP, 2014b).

Cfa - Figure 6.2.14-3 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 Maine. However, there are no expected increases in precipitation in fall other than fluctuations due to natural variability (USGCRP, 2014b).

Figure 6.2.14-4 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 under this scenario could increase as much as 10 percent. No significant change in fall and summer rainfall is anticipated over the same period (USGCRP, 2014b).

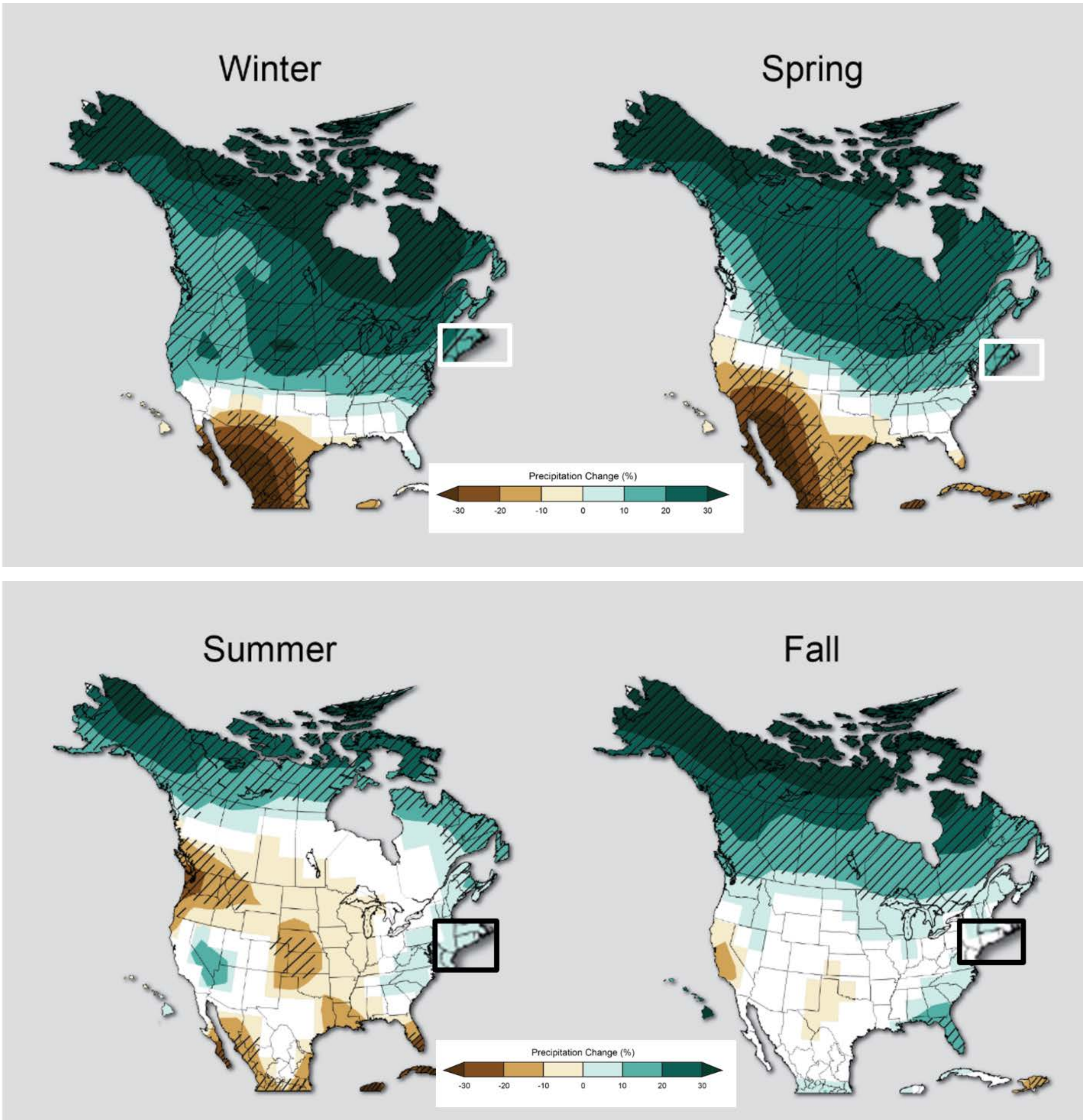
Dfa – Precipitation changes for the Dfa region are consistent with projected changes for the Cfa region of Maine in both low and high GHG emissions scenarios.

Dfb – Precipitation changes for the Dfb region are consistent with projected changes for the Cfa and Dfa regions of Maine in both low and high emissions scenarios.



Source: (USGCRP, 2014b)

Figure 6.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario



Source: (USGCRP, 2014b)

Figure 6.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

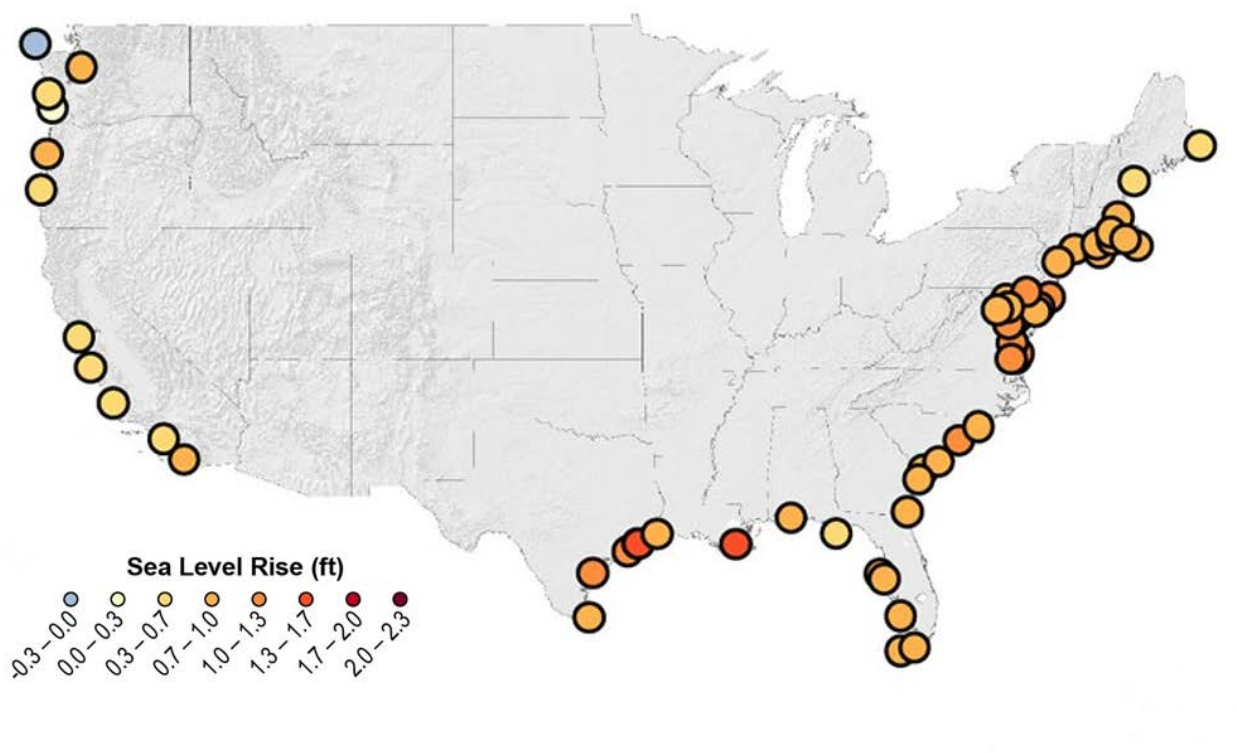
Sea Level

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 level rise scenarios. Variation in sea level rise along different stretches of coast is mostly due to varying rates of land subsidence (also known as relative sea level rise). In the National Climate Assessment, potential sea level rise scenarios were reported. These scenarios were developed based on varying degrees of ocean warming and ice sheet loss as estimated by organizations like IPCC (NOAA; USGS; SERPD; and USACE, 2012). Figure 6.2.14-5 and Figure 6.2.14-6 show feet of sea level above 1992 levels at different tide gauge stations. Figure 6.2.14-5 shows an 8 inch global sea level rise above 1992 levels by 2050 and Figure 6.2.14-6 shows a 1.24 foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014c).

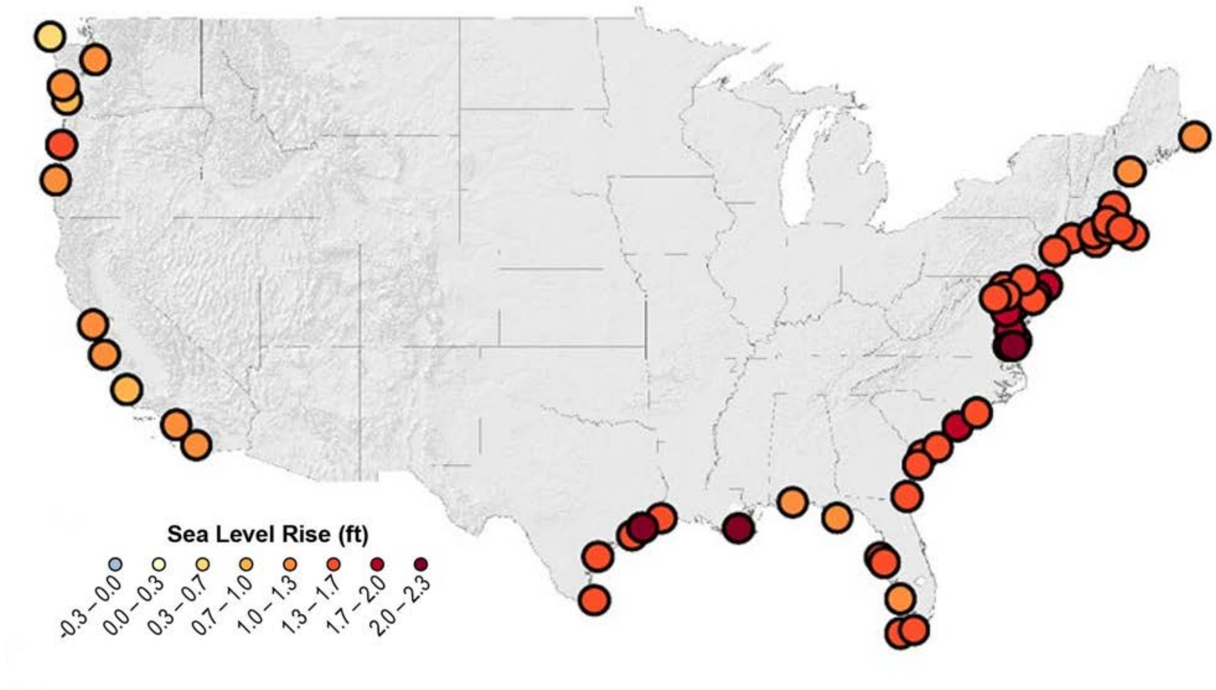
Cfa – Figure 6.2.14-5 presents an 8 inch global average sea level rise above 1992 levels resulting in a .7 to 1 foot sea level rise in 2050 along the coast of Maine. Figure 6.2.14-6 indicates that a 1.24 foot sea level rise above 1992 level would result in a 1.3 to 1.7 foot sea level rise in 2050 along the coast of Maine.

Dfa and *Dfb* – These Maine regions are not affected by sea level rise.



Source: (USGCRP, 2014c)

Figure 6.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050



Source: (USGCRP, 2014c)

Figure 6.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050

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 likely provide greater certainty (USGCRP, 2009).

6.2.14.4 *Description of Environmental Concerns*

Greenhouse Gas Emissions

Increases in GHG emissions have altered the global climate, leading to generalized temperature increases, weather disruption, increased droughts and heatwaves, and may have potentially catastrophic long-term consequences for the environment. Although GHGs are not yet regulated by the federal government, many states have set various objectives related to reducing GHG emissions, particularly CO_2 emissions from fossil fuels.

Based on the impact significance criteria presented in Table 6.2.14-1, 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, 2015h). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity would result in less CO_2 emissions than on-site provided energy. Using the average carbon intensity of grid-provided electricity of 1,136.53 lbs/MWh (USEPA, 2015l), the same transmitter would be responsible for approximately 271 MT of CO_2 per year running continuously. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Willem Vereecken, 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Project-Related Resources

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.

For example, as the northernmost state on the East Coast, Maine is less exposed to the direct effects of the landfall of a full-strength hurricane. However, Maine has 4,000 miles coastline and is at risk from stronger hurricane-driven storm surges during these events as well as regular coastal storms, particularly when combined with higher sea levels (Maine DEP, 2010b) (USGCRP, 2014g). Sea level rise would increase the height, areal extent, and persistence of coastal flooding during these events, damaging wetlands, and accelerating beach erosion. 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). Combined, these perturbations in natural systems may alter the commercially and ecologically important Gulf of Maine ecosystem with significant (although unknown) consequences for Maine's fisheries, economy, and tourism (Maine DEP, 2010b).

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. Inland areas of Maine at risk of increased flooding, climate change is projected to increase the frequency and severity of torrential downpours which in turn may increase the potential for flash flooding (Maine DEP, 2010b) (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 (U.S. Department of Energy, 2015) while sustained high temperatures may overwhelm the capacity onsite equipment needed to keep microwave and other transmitters cool.

6.2.14.5 Potential Impacts of the Preferred Alternative

Greenhouse Gas Emissions

The following section assesses potential GHG emission impacts associated with implementation of the Preferred Alternative in Maine, including deployment and operation activities.

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment and operation of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to GHG emissions, climate impacts in other resource areas, and FirstNet infrastructure and operations, and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action, the following are likely to have no impacts to climate change under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions. This would create no perceptible change in GHG emissions.
- Satellites and Other Technologies
  - 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 rights-of-way 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.
  - 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. Chapter 17 discusses BMPs and mitigation measures that could be implemented, as appropriate, 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. FirstNet installations should be evaluated in the design and planning phase through tiering to this analysis, in the context of their local geography and anticipated climate hazards to ensure they are properly hardened or there is sufficient redundancy to continue operations in a climate-affected environment. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would likely prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

6.2.14.6 Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term.

Operation 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. 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. 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. 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 Deployable Infrastructure or Operations

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 few GHG emissions associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Emissions would arise from use of power generators as the main power source. Emissions from the use of one fossil-fuel-powered generator would not be significant based on the defined significance criteria, since activities would be temporary and short-term. These potential impacts could be further reduced through implementation of the required BMPs and mitigation measures. 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 of time. 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 of time, 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 0, Climate Change.

6.2.15 Human Health and Safety

6.2.15.1 Introduction

This section describes potential impacts to human health and safety in Maine 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.

6.2.15.2 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 6.2.15-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to human health and safety addressed in this section are presented as a range of possible impacts.

Table 6.2.15-1: 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

6.2.15.3 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 6.2.15-1, occupational injury impacts could be potentially significant if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites. 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.

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.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed as a result of site activities. Based on the impact significance criteria presented in Table 6.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination using federal resources such as the USEPA Cleanups in My Community database, or through an equivalent commercial resource, such as Environmental Data Resources, Incorporated.

By screening sites for environmental contamination, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation may be required under RCRA, CERCLA, and applicable Maine state laws in order to protect workers and the general public from direct exposure or fugitive contamination.

Exposure assessments identify relevant site characteristics, temporal exposure parameters, and toxicity data to determine the likelihood of adverse health effects. More formally known as a human health risk assessment (HHRA), these studies provide mathematical justification for implementing controls at the site to protect human health. If the HHRA determines the potential for adverse health effects is too great the Maine DEP may require FirstNet to perform environmental clean-up actions at the site to lower the existing levels of contamination. HHRAs help determine which level of PPE (i.e., Level D, Level C, Level B, or Level A) is necessary for a work activity. HHRAs take into account all exposure pathways: absorption, ingestion, inhalation, and injection. Therefore, specific protective measures (e.g., controls and PPE) that disrupt the exposure pathways could be identified, prioritized, and implemented.

Natural and Manmade Disasters

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 6.2.15-1, 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.

6.2.15.4 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 development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy

equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

  - Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in limited nearshore and inland bodies of water requires workers to operate over aquatic and/or marine environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shore to accept submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would

require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, and historic 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.

6.2.15.5 Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source is an electrical generator, then there would also likely be a need to manage hazardous materials (fuel) onsite. These activities could result in less than significant impacts to human health and safety. 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 0, Human Health and Safety.

ME APPENDIX A – COMMUNITIES OF CONCERN

Table A-1: S1-Ranked Terrestrial Communities in Maine[141]

Community Type	Description	Distribution	State Rarity Rank
Alpine Cliff	Vegetation is a mixture of herbs, bryophytes[142], and dwarf shrubs found at or above treeline elevations, on sheer cliffs.	Found only in the highest mountains of the New England - Adirondack Province	S1
Atlantic White Cedar Bog	Peatlands[143] that occur in basin wetlands of the southwestern coast; typically in transitional areas between fens and bogs[144]. Dwarf heath shrubs with sparse tree cover of Atlantic white cedar dominate the peatlands.	Eastern Broadleaf Forest Province, extending southward from Maine	S1
Billberry-Mountain Heath Alpine Snowbank	Alpine shrub community that occupy protected upper mountain slopes above treelines.	Restricted to Maine's highest mountains (New England-Adirondack Province), extending west to New Hampshire and along the Appalachians.	S1
Chestnut Oak Woodland	Woodland community on dry ridges and south facing slopes.	Restricted to extreme southern Maine.	S1
Cotton-Grass-Heath Alpine Bog	Peat moss bog with scattered dwarf shrubs and herbs in alpine or subalpine settings.	Montane western Maine; known occurrences found on public or private conservation lands.	S1
Diapensia Alpine Ridge	Dwarf shrub community on very exposed and windswept areas above treelines.	Restricted to Maine's highest mountains, extending west to New Hampshire and along the Appalachians.	S1
Heath-Lichen Subalpine Slope Bog	Dwarf shrub bog community on nearly vertical talus[145] slides at elevations greater than 2000 Ft and subalpine settings.	Montane western Maine	S1
Hudsonia River Beach	Riverside barren that occurs in sandy floodplains.	Found from the Saco River in southern Maine and adjacent New Hampshire.	S1
Jack Pine Forest	Forest community on flat or rolling terrain at moderate elevations.	Limited to a small portion of northwestern Maine	S1
Little Bluestem - Blueberry Sandplain Grassland	Grassland barren community that occur on flat sandy plains or deep outwash deposits.	Extreme southern Maine, extending southward along the Atlantic Coast.	S1

[141] Wetland communities are described in Section 0.
[142] All bryophytes do not have true vascular tissue and are therefore called "non-vascular plants"
[143] Wetlands with a thick water-logged organic soil layer (peat) made up of dead and decaying plant material
[144] Wetlands characterized by spongy peat deposits, acidic waters and a floor covered by a thick carpet of sphagnum moss.
[145] Loose rock created by physical weathering

Community Type	Description	Distribution	State Rarity Rank
Mountain Alder - Bush-honeysuckle Subalpine Meadow	Mountain alder, shrub and graminoid[146] dominated meadows on mountain slopes, flats, or basins.	Upper-elevation ridges of Maine's western and central mountains	S1
Oak Hickory Forest	Hickory and oak forest community in low elevations	Restricted to southern and coastal	S1
Pitch Pine-Heath Barrens	Shrub-savanna on well-drained sandy or rocky soils.	Southern Maine, with a few sites in central Maine	S1
Pitch Pine Dune Woodland	Stunted woodland that occurs on coastal sand dunes.	South-coastal Maine, extending south along the Atlantic coastal plain	S1
Three-way Sedge - Goldenrod Outwash Plain Pondshore	This community consists of concentric zones of different herbs around a central pond.	Extreme southwestern Maine, extending southward along the coast to Massachusetts.	S1

Source: (Maine DACF, 2013b)

[146] Grass or grass-like plant, including grasses (Poaceae), sedges (Cyperaceae), rushes (Juncaceae), arrow-grasses (Juncaginaceae), and quillworts (Isoetes).

ACRONYMS

AAQS	Ambient Air Quality Standards
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AML	Abandoned Mine Lands
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act of 1979
ASL	Above Sea Level
ATC	Air Traffic Control
ATO	Air Traffic Organization
B	Billion
BGEPA	Bald and Golden Eagle Protection Act
BGR	Bangor International Airport
BJS	Bureau of Justice Statistics
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
BYA	Billion Years Ago
CAA	Clean Air Act
CCMP	Comprehensive Conservation and Management Plan
CEQ	Council On Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFA	Controlled Firing Areas
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH4	Methane
CIMC	Cleanups In My Community
CMR	Code of Maine Rules
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLT	Cell On Light Trucks
CONOPs	Concept of Operations
COW	Cell On Wheels
CRS	Community Rating System
CWA	Clean Water Act
DACF	Department of Agriculture, Conservation, and Forestry
DEP	Department of Environmental Protection

DHHS	Department of Human Health and Safety
DOC	Department of Commerce
DOT	Department of Transportation
DPS	Division of Public Safety
EFH	Essential Fish Habitats
EIA	Energy Information Agency
EMS	Emergency Medical Services
EOP	Emission Offset Provisions
EPCRA	Community Right To Know Act
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAQ	Frequently Asked Questions
FAR	Federal Aviation Regulations
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FFC	Fossil Fuel Combustion
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FLM	Federal Land Manager
FRA	Federal Railroad Administration
FSDO	Flight Standards District Offices
FSS	Flight Service Station
FTA	Federal Transit Administration
GAO	Government Accountability Office
GHG	Greenhouse Gas
GWDS	Groundwater Discharges
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IBA	Important Bird Area
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
LASER	Land Air Search and Rescue
LBS	Locations-Based Services
LMR	Land Mobile Radio
LRR	Land Resource Regions
LTE	Long Term Evolution
LUCF	land use change and forestry
LULUCF	Land Use Change, and Commercial Forestry
M	Million
MBTA	Migratory Bird Treaty Act

MCHT	Maine Coastal Heritage Trust
MDIF	Maine Department of Inland Fisheries
MDIFW	Maine Department of Inland Fisheries and Wildlife
MDMR	Maine Department of Marine Resources
MEDOL	Maine Department of Labor
MEMA	Maine Emergency Management Agency
MHI	Median Household Income
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tons
MNAP	Maine Natural Areas Program
MOA	Memorandum of Agreement
MPDES	Maine Pollution Discharge Elimination System
MPUC	Maine Public Utilities Commission
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MSZA	Maine Shoreline Zoning Act
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
NASAO	National Association of State Aviation Officials
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NESHAP	National Emission Standards for Hazardous Air Pollutant
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NM	Nautical Miles
NNL	National Natural Landmark
NOAA	National Ocean and Atmospheric Administration
NOTAM	Disseminated Via Notices To Airmen
NOx	Nitrous oxide
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	National Public Safety Broadband Network

NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NRPA	Natural Resources Protection Act
NSA	National Security Areas
NST	National Institute of Standards and Technology
NTIA	National Telecommunications and Information Administration
NWCC	Nationwide Car-to-Car Calling
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
NWS	National Weather Service
NYC	New York City
OAQPS	Office of Air Quality Planning and Standards
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OIT	Office of Information Technology
OSHA	Occupational Safety and Health Act
OTR	Ozone Transport Region
PAB	Palustrine Aquatic Bed
PEIS	Programmatic Environmental Impact Statement
PEM	Palustrine Emergent Wetlands
PFO	Palustrine Forested Wetlands
PGA	Peak Ground Acceleration
PHL	Philadelphia International Airport
PNGTS	Portland Natural Gas Transmission System
POP	Point of Presence
PPE	Personal Protective Equipment
PQI	Northern Maine Regional Airport at Presque Isle
PSAP	Public Safety Answering Point
PSC	Public Service Commission
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PSS	Scrub-Shrub Wetlands
PUB	Palustrine Unconsolidated Bottom
PWM	Portland International Jetport
RACT	Reasonably Available Control Technology
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
RFI	Request For Information
RGGI	Regional Greenhouse Gas Initiative
ROW	Right-of-Way
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates

SASP	State Aviation System Plan
SCIP	State Communication Interoperability Plan
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SHRI	Statewide Historic Resource Inventory
SIP	State Implementation Plan
SOP	Standard Operating Procedures
SOW	System On Wheels
SOx	Oxides of Sulfur
SPCC	State Police Car-to-Car
SPGP	State Program General Permit
SPL	Sound Pressure Level
SSA	Sole Source Aquifer
SUA	Special Use Airspace
SWAP	State Wildlife Action Plan
SWCC	Statewide Car-to-Car
SWPPP	Storm Water Pollution Prevention Plan
SWSP	Statewide State Police
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
TPY	Tons per Year
TRI	Toxics Release Inventory
TWA	Time Weighted Average
UAS	Unmanned Aircraft Systems
UHF	Ultra-High Frequency
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
USP	Uncontrolled Sites Program
UVA	University of Virginia
VCALL	VHF mutual aid calling
VFR	Visual Flight Rules
VHF	Very High Frequency
VMT	Vehicle Miles Traveled

VOC	Volatile Organic Compound
VR	Visual Route
VRAP	Voluntary Remediation Action Program
WSLS	Wetlands and Subaqueous Lands Section
WWI	World War I
WWII	World War II
YOY	Young of the Year

REFERENCES

40 CFR 230.3(t). (1993, August 25). *Clean Water Act-Guidelines for Specification of Disposal Sites for Dredged or Fill Material*. Retrieved April 6, 2015, from http://www.ecfr.gov/cgi-bin/text-idx?SID=7977290449ab243f2865159951305a77&node=40:25.0.1.3.24&rgn=div5

Abbe Museum. (2012). *Archeological Time Periods in Maine*. Retrieved Dec 3, 2015, from http://www.abbemuseum.org/research/archaeology/maine-timeline.html

Advisory Council on Historic Preservation. (2004, August 5). *36 CFR Part 800 - Protection of Historic Properties.* Retrieved July 21, 2015, from Advisory Council on Historic Preservation: http://www.achp.gov/regs-rev04.pdf

Almquest-Jacobson, H., & Sanger, D. (1995). Holocene Climate and Vegetation in the Milford Drainage Basin, Maine, U.S.A., and their Implications for Human History. (Springer, Ed.) *Vegetation History and Archaeobotany*, *4*(4), 211-222. Retrieved September 2015, from http://www.jstor.org/stable/23417805

Amtrak. (2015a). *Northeast Train Routes*. Retrieved July 1, 2015, from Amtrak: http://www.amtrak.com/northeast-train-routes

Amtrak. (2015b, April 6). *Amtrak System Timetable.* Retrieved from Amtrak: https://www.amtrak.com/ccurl/194/703/System-Timetable-Spring-Fall-2015.pdf

An Encyclopedia of Maine. (2015). *Archaeology*. Retrieved September 2015, from http://maineanencyclopedia.com/archaeology/

Balshe, W. (2011). *Power System Considerations for Cell Tower Applications.* Cummins Power Generation. Retrieved from https://www.cumminspower.com/www/literature/technicalpapers/PT-9019-Cell-Tower-Applications-en.pdf

Bangor International Airport. (2015, September). *History: The history of Bangor International Airport*. Retrieved September 2015, from http://www.flybangor.com/history

Baxter State Park Authority. (2012). *Baxter State Park*. Retrieved September 2015, from http://www.baxterstateparkauthority.com/index.htm

Beard, F. A., Smith, B. A., Bradley, R. L., & Spiess, A. E. (1982). *Maine's Historic Places.* Camden: Down East Books.

Berven, K. A., & Grudzien, T. A. (1990). Dispersal in the Wood Frog (Rana sylvatica): Implications for Genetic Population Structure. *Evolution*, 2047-56. doi:http://doi.org/10.2307/2409614

BJS. (2011, July 26). *Bureau of Justice Statistics*. Retrieved from http://www.bjs.gov/index.cfm?ty=pbdetail&iid=2216

BLM. (1984). *Manual 8400 - Visual Resource Management.* Washington: Department of the Interior, Bureau of Land Management.

BLM. (2014). *DRECP Noise and Vibration*. Retrieved 07 22, 2015, from http://www.blm.gov/style/medialib/blm/ca/pdf/pa/energy/drecp/draft_drecp.Par.37401.File.dat/III.21%20Noise%20and%20Vibration.pdf

BLS. (2016, March 30). *Telecommunications: NAICS 517*. Retrieved from Industries at a Glance: http://www.bls.gov/iag/tgs/iag517.htm

Bohlen, C., Stelk, M., Craig, M., & Gerber, a. C. (2013). *Sea Level Rise and Casco Bay's Wetlands: A Look at Potential Impacts.* Retrieved from http://www.cascobayestuary.org/wp-content/uploads/2014/06/2013_cbep_slr_report_portland.pdf.pdf

Bond, S., Sims, S., & Dent, P. (Eds.). (2013). *Towers, Turbines, and Transmission Lines: Impacts on Property Value.* Chichester, West Sussex, United Kingdom: Wiley-Blackwell.

Bryce, S. A., Griffith, G. E., Omernik, J. M., Edinger, G., Indrick, S., Vargas, O., & Carlson, D. (2010). *Ecoregions of New York.* Retrieved July 1, 2015, from http://www.epa.gov/wed/pages/ecoregions/ny_eco.htm

Burt, W. (1976). A Field Guide to the Mammals of North America north of Mexico. Boston, MA: Houghton Mifflin.

Calhoun, A. J., & DeMaynadier, P. G. (2007). *Science and Conservation of Vernal Pools in Northeastern North America: Ecology and Conservation of Seasonal Wetlands in Northeastern North America.* CRC Press. Retrieved September 2015, from http://www.nae.usace.army.mil/Portals/74/docs/regulatory/VernalPools/Ch12_ScienceConservationofVernalPools.pdf

Carter, J.M.; Driscoll, D.G.; Williamson, J.E.; Lindquist, V.A. (2007). *Atlas of Water Resources in the Black Hills Area, South Dakota.* Retrieved July 2015, from http://pubs.usgs.gov/ha/ha747/

Casco Bay Estuary Project. (1996). *Casco Bay Plan.* Retrieved June 28, 2015, from Casco Bay Estuary Program: http://www.cascobayestuary.org/wp-content/uploads/2014/07/1996_cbep_casco_bay_plan.pdf

CEQ. (1997, December). *Environmental Justice: Guidance Under the National Environmental Policy Act.* Retrieved April 2015, from http://energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-EJGuidance.pdf

CEQ. (2014). *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*. Retrieved June 2014, from https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance

Charpentier, V., & Inizan, F.-A. J. (2002). Fluting in the Old World: The Neolithic Projectile Points of Arabia. *Lithic Technology*, *27*(1), 39-46. Retrieved August 2015, from http://www.jstor.org/stable/23273456

Churchill, J. (2015, September 10). Maine Department of Environmental Protection, Office of Innovation and Assistance. Email correspondence with Jennifer Nystrom.

CIO Council. (2015). *Data Center Consolidation and Optimization*. Retrieved from https://cio.gov/drivingvalue/data-center-consolidation/

City of Lincoln. (2015). *What are Saline Wetlands?* Retrieved July 2015, from http://lincoln.ne.gov/city/parks/parksfacilities/wetlands/wetlandsinfo.htm

City of Portland, Maine. (2011). *Community Inventory of Greenhouse Gas Emissions*, *2010*. Retrieved 7 29, 2015, from http://www.portlandmaine.gov/DocumentCenter/View/6278

City of Portland, Maine. (2015a). *Climate Adaptation*. Retrieved 2015, from PortlandMaine.Gov: http://www.portlandmaine.gov/1293/Climate-Policy

City of Portland, Maine. (2015b). *Climate Adaptation(b)*. Retrieved 2015, from PortlandMaine.Gov: http://www.portlandmaine.gov/1307/Climate-Adaption

Cole-Will, R., & Will, R. (1996). A Probable Middle Archaic Cemetery: The Richmond Castle Site in Surry, Maine. *Archaeology of Eastern North America*, *24*, 149-158. Retrieved September 2015, from http://www.jstor.org/stable/40914408

Cowardin, L. M., Carter, V., Golet, F. C., & LaRoe, E. T. (1979). *Classification of wetlands and deepwater habitats of the United States, FWS/OBS-79/31*. Retrieved April 5, 2015, from http://www.fws.gov/wetlands/Documents/classwet/index.html

Crock, J. G., Peterson, J. B., & Anderson, R. M. (1993). Scalloping for Artifacts: A Biface and Plummet from Eastern Blue Hill Bay, Maine. *Archaeology of Eastern North America, 21*, 179-192. Retrieved September 2015, from http://www.jstor.org/stable/40914372

CSC. (2007, March). Retrieved from Telecommunications Facilities: An Illustrated Primer on the Siting of Facilities within Connecticut and Throughout the Nation: http://www.ct.gov/csc/lib/csc/csc_tower_3_07.pdf

Cullingworth, B., & Caves, R. W. (2014). Planning in the USA, Fourth Edition. New York. Retrieved from https://books.google.com/books?id=jRNpAQAAQBAJ&pg=PA237&lpg=PA237&dq=comprehensive+planning+and+land+use+act+of+maine+1988&source=bl&ots=b6BGsN47k3&sig=lcz4uukWN_MMsU7GQX-d5uR7Oq4&hl=en&sa=X&ei=sU2VVdedCIXUoAS40KP4Dw&ved=0CD8Q6AEwBw#v=onepage&q=comprehens

De-Campos, Alfredo; Mamedov, Amrakh; Huang, Chi-hua. (2009). Short-Term Reducing Conditions Decrease Aggregation. *Soil Science Society of America Journal*, 550-559. Retrieved November 2013, from http://www.sciencedaily.com/releases/2009/04/090408140204.htm

DeSorbo, C., Wright, K., Johnson, I., & Gray, R. (2012). *Bird Migration Stopover Sites: Ecology of Nocturnal and Diurnal Raptors at Mohegan Island*. Retrieved from http://www.briloon.org/uploads/BRI_Documents/Raptors/BRI%202012-08%20Bird%20migration%20stopover%20sites.pdf

Di Gregorio, A., & Jansen, L. J. (1998). *Land Cover Classification System (LCCS): Classification Concepts and User Manual*. Rome: Food and Agriculture Organization of the United Nations.

Dodd, L.E. et al. (2011). Forest structure impacts affects trophic linkages: How silvicultural disturbance impacts bats and their insect prey. *Forest Ecology and Management*, 262-270.

Ducks Unlimited. (2015). *DU Projects: Atlantic Flyway*. Retrieved July 1, 2015, from http://www.ducks.org/printPage.aspx?documentID=7184

eBird. (2015a). *eBird Range Map--Bald Eagle*. Retrieved from http://ebird.org/ebird/map/baleag?bmo=1&emo=12&byr=2011&eyr=2015&__hstc=75100365.64b7254677ac8cc5c8f21aa17c0b9689.1442877327577.1442877327577.1442877327577.1&__hssc=75100365.4.1442877327577&__hsfp=3470679313#_ga=1.21938685.790432658.1442877326

eBird. (2015b). *eBird Range Map--Golden Eagle*. Retrieved from http://ebird.org/ebird/map/goleag?bmo=1&emo=12&byr=2011&eyr=2015#_ga=1.21938685.790432658.1442877326

Edinger, G. J., Evans, D. J., Gebauer, S., Howard, T. G., Hunt, D. M., & Olivero, A. M. (2014, March). *Ecological Communities of New York State*. Retrieved March 19, 2015, from A revised and expanded edition of Carol Reschke's Ecological Communities of New York State.: http://www.dec.ny.gov/animals/97703.html

EIA. (2014). *State-Level Energy-Related Carbon Dioxide Emissions 2001-2011*. Retrieved from http://www.eia.gov/environment/emissions/state/analysis/

EIA. (2015a, July). *Maine Overview*. Retrieved July 2015, from U.S. Energy Information Administration: http://www.eia.gov/state/?sid=ME

EIA. (2015b, August). *Glossary-G.* Retrieved August 2015, from U.S. Energy Information Administration: http://www.eia.gov/tools/glossary/index.cfm?id=W

EIA. (2015c). *Maine State Energy Profile.* Retrieved June 2015, from http://www.eia.gov/state/print.cfm?sid=ME

EIA. (2015d, October 26). *State Carbon Dioxide Emissions*. Retrieved February 11, 2016, from http://www.eia.gov/environment/emissions/state/

EIA. (2015e, October 26). *Energy-Related CO2 Emissions at the State Level, 2000-2013*. Retrieved February 11, 2016, from http://www.eia.gov/environment/emissions/state/analysis/

EIA. (2015f). *State energy-related carbon dioxide emissions by year (2000 to 2013).* Retrieved 7 22, 2015, from http://www.eia.gov/environment/emissions/state/analysis/pdf/table1.pdf

EIA. (2015g). *Natural Gas Pipelines in the Northeast Region*. Retrieved 08 11, 2015, from Natural Gas: http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/northeast.html

EIA. (2015h, July 7). *How much carbon dioxide is produced by burning gasoline and diesel fuel?* Retrieved September 21, 2015, from http://www.eia.gov/tools/faqs/faq.cfm?id=307&t=11

Elias, T. S. (1989). *Field Guide to North American Trees.* CT: Grolier Book Clubs.

Executive Office of the President. (1994, February). *Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. Retrieved April 2015, from 59 Federal Register 7629: https://federalregister.gov/a/94-3685

FAA. (2008). *Chapter 14 Airspace.* Retrieved June 2015, from Pilot's Handbook of Aeronautical Knowledge: http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/pilot_handbook/media/phak%20-%20chapter%2014.pdf

FAA. (2012, 04 05). *Advisory Circular AC 36-3H*. Retrieved 07 22, 2015, from http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC36-3H%20Chg%201.pdf

FAA. (2013). *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap.* Washington D.C.: U.S. Department of Transportation Federal Aviation Administration.

FAA. (2014a, January). *Federal Aviation Administration, Air Traffic Organization*. Retrieved June 2015, from http://www.faa.gov/about/office_org/headquarters_offices/ato/

FAA. (2015a, June 25). *Airport Data and Contact Information*. Retrieved July 10, 2015, from http://www.faa.gov/airports/airport_safety/airportdata_5010/

FAA. (2015b). *Aviation System Performance Metrics (ASPM) Database*. Retrieved 07 22, 2015, from https://aspm.faa.gov/apm/sys/AnalysisAP.asp

FAA. (2015c, March). *Flight Standards District Offices (FSDO)*. Retrieved June 2015, from http://www.faa.gov/about/office_org/field_offices/fsdo/

FAA. (2015d). *Aeronautical Information Manual*. Retrieved 2015 August, from http://www.faa.gov/air_traffic/publications/media/aim.pdf

FAA. (2015e). *Obstruction Evaluation / Airport Airspace Analysis (OE/AAA)*. Retrieved July 2015, from Federal Aviation Administration: https://oeaaa.faa.gov/oeaaa/external/portal.jsp

FAA. (2015f). *Air Traffic Organization Policy Order JO 7400.8X, Subject: Special Use Airspace.* Retrieved July 2015, from http://www.faa.gov/documentlibrary/media/order/7400_8x_2015.pdf

FAA. (2015g, August). *FAA Pilot Safety Brochure - Hearing and Noise in Aviation.* Retrieved 08 05, 2015, from FAA.gov: https://www.faa.gov/pilots/safety/pilotsafetybrochures/media/hearing_brochure.pdf

FCC. (2000, August). *Deployment of Advanced Telecommunications Capability: Second Report.* Retrieved Nov 16, 2015, from https://transition.fcc.gov/Bureaus/Common_Carrier/Orders/2000/fcc00290.pdf

FCC. (2014a). *Internet Access Servies: Status as of December 31, 2013.* Industry Analysis and Technology Division Wireline Competition Bureau. Federal Communications Commission.

FCC. (2014b). *Local Telephone Competition: Status as of December 31, 2013.* Industry Analysis and Technology Division Wireline Competition Bureau.

FCC. (2015a, October 23). *Office of Emergency Communications*. Retrieved from Homeland Security: https://www.dhs.gov/office-emergency-communications

FCC. (2015b, June 17). *Antenna Structure Registration*. Retrieved June 17, 2015, from Federal Communications Commission: http://wireless2.fcc.gov/UlsApp/AsrSearch/asrRegistrationSearch.jsp

FCC. (2016a, March). *National Broadband Plan Chapter 16 Public Safety*. Retrieved March 29, 2016, from Broadband.gov: http://www.broadband.gov/plan/16-public-safety/

FCC. (2016b, February 1). *Tower and Antenna Siting*. Retrieved February 10, 2016, from https://www.fcc.gov/general/tower-and-antenna-siting

Federal Mining Dialogue. (2015a, January 6). *Abandoned Mine Lands Portal - Staying Safe*. Retrieved September 29, 2015, from http://www.abandonedmines.gov/ss.html

Federal Railroad Administration. (2015). *Federal Railroad Administration Horn Noise FAQ*. Retrieved 07 22, 2015, from https://www.fra.dot.gov/Page/P0599

FEMA. (2000). *44 CFR Section 59.1 of the National Flood Insurance Program (NFIP) Regulations: Definitions of NFIP Terms.* Retrieved May 2015, from http://www.fema.gov/media-library/assets/documents/12437?id=3064

FEMA. (2009). *Maine Severe Storms, Flooding, and Landslides (DR-1852).* Retrieved June 2015, from https://www.fema.gov/disaster/1852#

FEMA. (2010, March). *Guidelines for Estimation of Percolation losses for NFIP Studies.* Retrieved August 6, 2015, from FEMA: http://www.fema.gov/media-library-data/20130726-1731-25045-9495/dl_perc.pdf

FEMA. (2013). *Unit 3: NFIP Flood Studies and Maps*. Retrieved May 2015, from http://www.fema.gov/media-library-data/20130726-1539-20490-0241/nfip_sg_unit_3.pdf

FEMA. (2014a, May). *Chapter 8: Floodplain Natural Resources and Functions*. Retrieved May 2015, from https://training.fema.gov/hiedu/docs/fmc/chapter%208%20-%20floodplain%20natural%20resources%20and%20functions.pdf

FEMA. (2014b, May). *Chapter 2: Types of Floods and Floodplains*. Retrieved May 2015, from http://training.fema.gov/hiedu/docs/fmc/chapter%202%20-%20types%20of%20floods%20and%20floodplains.pdf

FEMA. (2014c, June). *Community Rating System*. Retrieved May 2015, from http://www.fema.gov/media-library-data/1398878892102-5cbcaa727a635327277d834491210fec/CRS_Communites_May_1_2014.pdf

FEMA. (2015a). *Disater Declarations for Maine*. Retrieved July 2015, from https://www.fema.gov/disasters/grid/state-tribal-government/32?field_disaster_type_term_tid_1=6837&=GO

FEMA. (2015b, May). *The National Flood Insurance Program Community Status Book*. Retrieved July 2015, from http://www.fema.gov/national-flood-insurance-program/national-flood-insurance-program-community-status-book

FEMA. (2015c, April). *Floodplain Management Fact Sheet*. Retrieved May 2015, from https://www.fema.gov/floodplain-management-fact-sheet

Fenneman, N. (1916). *Physiographic Subdivision of the United States*. Retrieved April 2015, from http://www.pnas.org/content/3/1/17.full.pdf?ck=nck

FGDC. (2013, August). *Classification of Wetlands and Deepwater Habitats of the United States*. Retrieved April 17, 2015, from FGDC Subcommittee on Wetlands Data: http://www.fgdc.gov/standards/projects/FGDC-standards-projects/wetlands/nvcs-2013

FHWA. (2011, 7 14). *Highway Traffic and Construction Noise*. Retrieved 07 27, 2015, from fhwa.dot.gov: http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/probresp.cfm#appendix

FHWA. (2015a). *Acadia All-American Road*. Retrieved July 15, 2015, from http://www.fhwa.dot.gov/byways/byways/13791

FHWA. (2015b). *Old Canada Road Scenic Byway*. Retrieved July 15, 2015, from http://www.fhwa.dot.gov/byways/byways/11510

FHWA. (2015c). *Rangeley Lakes Scenic Byway*. Retrieved July 15, 2015, from http://www.fhwa.dot.gov/byways/byways/13830

FHWA. (2015d). *Schoodic Scenic Byway*. Retrieved July 15, 2015, from http://www.fhwa.dot.gov/byways/byways/13792

FHWA. (2015e). *America's Byways*. Retrieved June 2015, from http://www.fhwa.dot.gov/byways/

FHWA. (2015f, 05 28). *Highway Traffic Noise*. Retrieved 07 22, 2015, from http://www.fhwa.dot.gov/environment/noise/regulations_and_guidance/faq_nois.cfm

Fiber Optic Association. (2010). *Guide to Fiber Optics & Premises Cabling*. Retrieved September 21, 2015, from Safety in Fiber Optic Installations: http://www.thefoa.org/tech/safety.htm

Fiedel, S. J. (2001). What Happened in the Early Woodland? *Archaeology of Eastern North America, 29*, 101-142. Retrieved September 2015, from http://www.jstor.org/stable/40914448

Forest Health & Monitoring Division. (2011). *Forest & Shade Tree Insect & Disease Conditions*. Augusta, Maine: Maine Forest Service.

Freimund, W. (2009, December). Managing the natural soundscape: The National Park Service as a learning organization. *EBSCO Host*.

FTA. (2006). *Transit Noise and Vibration Impact Assessment*. FTA.

Gallo, S., Hodgeman, T., & Camuso, J. (2008). *Important Bird Areas of Maine, an analysis of avian diversity and abundance*. Retrieved from http://maineaudubon.org/wp-content/uploads/2011/10/IBAsitedescriptions-final.pdf

GAO. (2013). *Data Center Consolidation: Strengthened Oversight Needed to Achieve Billions of Dollars in Savings*. Retrieved from http://www.gao.gov/products/GAO-13-627T

Gehring, J., Kerlinger, P., & and Manville, A. M. (2011). "The Role of Tower Height and Guy Wires on Avian Collisions with Communication Towers.". *The Journal of Wildlife Management*, 848-855. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/jwmg.99/abstract.

Grand Lake Stream Area Chamber of Commerce. (2012). *Maine's Outdoor Sporting Paradise*. Retrieved September 2015, from http://grandlakestream.org/

Harrington, W. (1982). The endangered species act and the search for balance. *Natural Resources Journal, 21*, 71-92. Retrieved from http://lawschool.unm.edu/nrj/volumes/21/1/04_harrington_endangered.pdf

Harris, E. C. (1979). The Laws of Archaeological Stratigraphy. *World Archaeology, 11*(1), 111-117. Retrieved July 2015, from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CB4QFjAAahUKEwjz-8uDzoXHAhWMFpIKHXZnAWk&url=http%3A%2F%2Fusers.clas.ufl.edu%2Fdavidson%2FProseminar%2FWeek%252012%2520Time%2FHarris%25201979%2520laws%2520of%2520stratigraphy.pdf&ei=

Hawkins, D. G. (1979, March 19). Notification to Federal Land Manager Under Section 165(d) of the Clean Air Act. Retrieved April 21, 2015, from http://www.epa.gov/region7/air/nsr/nsrmemos/fdlndmgr.pdf

Haynes, C. V., Donahue, D., Jull, A., & Zabel, T. (1984). Application of Accelerator Dating to Fluted Point Paleoindian Sites. *Archaeology of Eastern North America, 12*, 184-191. Retrieved September 2015, from http://www.jstor.org/stable/40914238

Haynes, V. T., Johnson, E., & Stafford, T. W. (1999). AMS Radiocarbon Dating of the Type Plainview and Firstview (Paleoindian) Assemblages: The Agony and the Ecstasy. *American Antiquity, 64*(3), 444-454. Retrieved September 2015, from http://www.jstor.org/stable/2694144

Highsmith, C. M. (1980). The Cape Neddick, or "Nubble," Light. *Library of Congress Prints & Photographs Online Collection*. York, Maine: Library of Congress. Retrieved September 2015, from http://www.loc.gov/resource/highsm.14778/

Hill, D. (1997). Bird Disturbance: Improving the Quality and Utility of Disturbance Research. *Journal of Applied Ecology*, 34(2): 275-288.

Historic American Buildings Survey. (1933a). George W. Bourne House, 104 Summer Street (State Route 35), Kennebunk, York County, ME. *Library of Congress Prints & Photographs Online Collection*. Kennebunk, Maine: Library of Congress. Retrieved September 2015, from http://www.loc.gov/resource/hhh.me0169.photos/?sp=1

Historic American Buildings Survey. (1933b). Historic American Buildings Survey Print of Old Photograph, Showing Extension at West End of Building (Extension built about 1740 - removed some years ago) c. 1908 - McIntire-Garrison House, South Berwick Road (State Route 91), Scotland, York County, ME. *Library of Congress Prints & Photographs Online Collection*. Scotland, Maine: Library of Congress. Retrieved September 2015, from http://www.loc.gov/resource/hhh.me0083.photos/?sp=1

Historic American Buildings Survey. (1933c). Shaker Church Family Washhouse, East of State Route 26, South of North Raymond Road, centrally located in church family area, Sabbathday Lake Village, Cumberland County, ME. *Library of Congress Prints &*

Photographs Online Collection. Sabbathday Lake Village, Maine: Library of Congress. Retrieved September 2015, from http://www.loc.gov/resource/hhh.me0009.photos

Holiday, V. T., Johnson, E., & Stafford, T. W. (1999). AMS Radiocarbon Dating of the Plainview and Firstview (Paleoindian) Assemblages: The Agony and the Ecstasy. *American Antiquity, 64*(3), 444-454. Retrieved August 2015, from http://www.jstor.org/stable/2694144

Homan, R. N., Atwood, M. A., Dunkle, A. J., & Karr, S. B. (2010, January 5). *Movement Orientation by Adult and Juvenile Wood Frogs (Rana sylvatica) and American Toads (Bufo americanus) Over Multiple Years.* Retrieved from http://www.herpconbio.org/Volume_5/Issue_1/Homan_etal_2010.pdf

Institute of Maritime History. (2015, August). *Rainsford Island Archaeological Survey*. Retrieved August 2015, from http://www.maritimehistory.org/content/rainsford-island-archaeological-survey

International Finance Corporation. (2007, April 30). *Environmental, Health, and Safety Guidelines for Telecommunications*. Retrieved from http://www.ifc.org/wps/wcm/connect/0985310048855454b254f26a6515bb18/Final+-+Telecommunications.pdf?MOD=AJPERES&id=1323152343828

IPCC. (2007). *Climate Change 2007: Synthesis Report.* Retrieved October 2013, from Intergovernmental Panel on Climate Change: www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf

IPCC. (2013). *Climate Change 2013: The Physical Science Basis.* Intergovernmental Panel on Climate Change. Retrieved from https://www.ipcc.ch/report/ar5/wg1/

Jacobson, G. L. (2015). *Maine's Climate: The Cocorah's State Climate Series.* Retrieved September 02, 2015, from Maine’s moist climate: Strongly variable seasonal temperatures with even precipitation: http://www.cocorahs.org/Media/docs/ClimateSum_ME.pdf

Johnson, J. (2010). *Coastal Hazards in Connecticut.* Retrieved June 2015, from http://www.ct.gov/deep/lib/deep/long_island_sound/coastal_hazards/ct_coastal_hazards.pdf

Judd, R. W. (1995). *Maine: The Pine Tree State from Prehistory to the Present.* (E. A. Churchill, & J. W. Eastman, Eds.) Orono: University of Maine Press.

Kottek, M., Grieser, J., Beck, C., Rudolf, B., & Rubel, F. (2006). *World Map of the Koppen-Geiger Climate Classification Updated.* Global Precipitation Climatology Centre. Ofenbach: Deutscher Wetterdienst. Retrieved June 2015, from http://koeppen-geiger.vu-wien.ac.at/pdf/Paper_2006.pdf

Laub, R. S. (2000). A Second Dated Mastodon Bone Artifact from Pleistocene Deposits at the Hiscock Site (Western New York State). *Archaeology of Eastern North America, 28*, 141-154. Retrieved September 2015, from http://www.jstor.org/stable/40914441

Levine, M. A. (2004). The Clauson Site: Late Archaic Settlement and Subsistence in the Uplands of Central New York. *Archaeology of Eastern North America, 32*, 161-181. Retrieved August 2015, from http://www.jstor.org/stable/40914480

Lightfoot, K. G., & Cerrato, R. M. (1988). Prehistoric Shellfish Exploitation in Central New York. *Journal of Field Archaeology, 15*(2), 141-149. Retrieved August 2015, from http://www.jstor.org/stable/530300

Maine Audubon. (2016). *Birding in Maine*. Retrieved from http://maineaudubon.org/birding/

Maine DACF. (2010). *Maine State Forest Assessment and Strategies.* Augusta: Department of Conservation, Maine Forest Service, Forest Policy and Management Division.

Maine DACF. (2012). *Allagash Wilderness Waterway Management Plan*. Retrieved August 6, 2015, from http://www.maine.gov/dacf/parks/get_involved/planning_and_acquisition/management_plans/docs/AWW_Final_mgt_plan_2012.pdf

Maine DACF. (2013a). *Maine Natural Areas Program: Circumneutral Fen*. Retrieved Dec 3, 2015, from http://www.maine.gov/dacf/mnap/features/communities/circumneutralfen.htm

Maine DACF. (2013b). *Maine Natural Areas Program - Ecological Reserve System*. Retrieved September 16, 2015, from http://www.maine.gov/dacf/mnap/reservesys/index.htm

Maine DACF. (2013c). *Sandplain Grassland*. Retrieved September 9, 2015, from https://www1.maine.gov/dacf/mnap/features/communities/littlebluestem.htm

Maine DACF. (2013d). *Farming*. Retrieved September 10, 2015, from http://www.maine.gov/dacf/farming/index.html

Maine DACF. (2013e). *Allagash Wilderness Waterway*. Retrieved September 2015, from http://www.maine.gov/cgi-bin/online/doc/parksearch/search_name.pl?state_park=2&historic_site=&public_reserved_land=&shared_use_trails=&option=search

Maine DACF. (2013f). *Kennebec Valley Trail*. Retrieved September 2015, from http://www.maine.gov/cgi-bin/online/doc/parksearch/details.pl?park_id=74

Maine DACF. (2013g). *Four Seasons Adventure Trail*. Retrieved August 2015, from http://www.maine.gov/cgi-bin/online/doc/parksearch/details.pl?park_id=95

Maine DACF. (2013h). *Roque Bluffs State Park*. Retrieved September 2015, from http://www.maine.gov/cgi-bin/online/doc/parksearch/details.pl?park_id=23

Maine DACF. (2014, September 18). *State Parks and Public Lands: State Parks, State Historic Sites, and Public Reserved Lands*. Retrieved July 1, 2015, from http://www.maine.gov/dacf/parks/camping/pdf/outdoorsmini.pdf

Maine DACF. (2015a). *State Parks and Public Lands: Public Reserved Lands*. Retrieved July 1, 2015, from http://www.maine.gov/dacf/parks/about/public_reserved_lands.shtml

Maine DACF. (2015b). *Find Parks and Lands: Search Results*. Retrieved September 2015, from http://www.maine.gov/cgi-bin/online/doc/parksearch/index.pl?state_park=&historic_site=&public_reserved_land=&shared_use_trails=&town=&distance=&search_radio=3&search_type_radio=on&Aroostook+County=Y&Downeast+%26+Acadia=Y&Greater+Portland+%26+Casco+Bay=Y&K

Maine DACF. (2015c). *Maine Natural Areas Program: Natural Heritage Hikes*. Retrieved June 30, 2015, from http://www.maine.gov/dacf/mnap/assistance/heritage_hikes.htm

Maine DEC. (2003, Feb 14). *Earthquakes in Maine.* Retrieved Dec 3, 2015, from https://www1.maine.gov/dacf/mgs/pubs/online/quakes/quake11x17

Maine DEH. (2015a, July). *Reporting*. Retrieved July 2015, from Drinking Water Program: http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/pws/reporting.shtml

Maine DEH. (2015b, July). *Maine Subsurface Wastewater Team*. Retrieved July 2015, from Division of Environmental Health: http://www.maine.gov/dhhs/mecdc/environmental-health/plumb/

Maine DEP. (1991, June). *Wetland Types*. Retrieved June 25, 2015, from http://www.maine.gov/dep/water/wetlands/types.html

Maine DEP. (1996, September). *Maine's Wetlands: Their Functions and Values*. Retrieved June 25, 2015, from http://www.maine.gov/dep/water/wetlands/ipwetfv2.html

Maine DEP. (2002). *Maine Pollution Discharge Elimination System Standard Conditions Applicable to All Permits*. Retrieved July 10, 2015, from http://www.maine.gov/dep/water/wd/permit_standard_conditions.pdf

Maine DEP. (2007a). *Historic Flooding in Major Drainage Basins, Maine.* Retrieved June 17, 2015, from Department of Agriculture, Conservation, and Forestry: http://maine.gov/dacf/flood/docs/maineriverbasin/maineriverbasinreport.pdf

Maine DEP. (2007b, January/February). *Scenic and Aesthetic Impacts: Knowing It when You See It in Maine.* Retrieved June 24, 2015, from National Oceanic and Atmospheric Administration: https://coast.noaa.gov/magazine/2007/01/issue.pdf

Maine DEP. (2007c). *Vernal Pool Regulation in Maine: Answers to FAQ.* Harpswell: Maine DEP. Retrieved from http://harpswell.maine.gov/vertical/Sites/%7B3F690C92-5208-4D62-BAFB-2559293F6CAE%7D/uploads/%7BC68CE5D0-CBF7-4A22-92B1-001E6222D6D2%7D.PDF

Maine DEP. (2008, October). *Permit-by-Rule (NRPA).* Retrieved September 17, 2015, from http://www.maine.gov/dep/land/nrpa/ip-pbr.html

Maine DEP. (2009, April). *Vernal Pools: A Significant Wildlife Habitat*. Retrieved September 16, 2015, from https://www1.maine.gov/dep/land/nrpa/vernalpools/fs-vernal_pools_intro.html

Maine DEP. (2010b). *People and Nature: Adapting to a Changing Climate - Charting Maine's Course.* Retrieved February 14, 2016, from http://www.maine.gov/dep/sustainability/climate/preparation-adaptation.html

Maine DEP. (2011a). *Title 38: Waters and Navigation*. Retrieved July 10, 2015, from http://legislature.maine.gov/statutes/38/title38sec413.html

Maine DEP. (2011b, Sept 13). *September Environmental Column from Maine DEP: Groundwater Protection Starts At Home*. Retrieved Dec 3, 2015, from http://www.maine.gov/dep/news/news.html?id=302277

Maine DEP. (2012a). *2012 Integrated Water Quality Monitoring and Assessment Report*. Retrieved June 17, 2015, from Maine Department of Environmental Protection: http://www.maine.gov/dep/water/monitoring/305b/2012/report-final.pdf

Maine DEP. (2012b). *Water Quality Monitoring and Assessment Report Apendices*. Retrieved August 6, 2015, from http://www.maine.gov/dep/water/monitoring/305b/2012/appendices-final.pdf

Maine DEP. (2012c, August 6). 110 - Ambient Air Quality Standards. Retrieved July 21, 2015, from http://www.maine.gov/sos/cec/rules/06/096/096c110.doc

Maine DEP. (2012d, December 1). 115 - Major and Minor Source Air Emission License Regulation. Retrieved July 21, 2015, from http://www.maine.gov/sos/cec/rules/06/096/096c115.doc

Maine DEP. (2013a). *Waste Discharge Program*. Retrieved September 17, 2015, from http://www.maine.gov/dep/water/wd/index.html

Maine DEP. (2013b). *Threats to Wetlands*. Retrieved June 25, 2015, from http://www.maine.gov/dep/water/wetlands/threats.htm

Maine DEP. (2013c). Ozone Exceedance Summaries. Retrieved July 21, 2015, from http://www.maine.gov/dep/air/ozone/view_exceedance_data.html

Maine DEP. (2015a, July). *Wastewater Treatment*. Retrieved July 2015, from Maine Department of Environmental Protection: http://www.maine.gov/dep/water/wwtreatment/

Maine DEP. (2015b, July). *Solid Waste Management*. Retrieved July 2015, from Maine Department of Environmental Protection: http://www.maine.gov/dep/waste/solidwaste/

Maine DEP. (2015c, July). *Active/Licensed Landfills*. Retrieved July 2015, from Maine Department of Environmental Protection: http://www.maine.gov/dep/maps-data/documents/swactiveliclf.pdf

Maine DEP. (2015d, July). *Electronics Recycling*. Retrieved July 2015, from Maine Department of Environmental Protection: http://www.maine.gov/dep/waste/ewaste/index.html

Maine DEP. (2015e, July). *Recycling*. Retrieved July 2015, from Maine Department of Environmental Protection: http://www.maine.gov/dep/waste/recycle/index.html

Maine DEP. (2015f). *Natural Resources Protection Act (NRPA)*. Retrieved July 10, 2015, from http://www.maine.gov/dep/land/nrpa/index.html

Maine DEP. (2015g). *Water Quality Certification*. Retrieved August 5, 2015, from http://www.maine.gov/dep/water/wd/wqc/

Maine DEP. (2015h). *Maine Coastal Program.* Retrieved June 28, 2015, from Department of Agriculture, Conservation, and Forestry: http://www.maine.gov/dacf/mcp/planning/index.htm

Maine DEP. (2015i). *Natural Resources Protection Act (NRPA)*. Retrieved June 25, 2015, from http://www.maine.gov/dep/land/nrpa/

Maine DEP. (2015j). *Mandatory Shoreland Zoning*. Retrieved September 17, 2015, from http://www.maine.gov/dep/land/slz/

Maine DEP. (2015k). *Site Location of Development (Site Law)*. Retrieved September 14, 2015, from http://www.maine.gov/dep/land/sitelaw/

Maine DEP. (2015l, August 03). *Spills and Site Cleanup Program*. Retrieved from http://www.maine.gov/dep/spills/programs/index.html

Maine DHHS. (2013). *Division of Environmental Health*. Retrieved September 9, 2015, from http://www.maine.gov/dhhs/mecdc/environmental-health/index.shtml

Maine Geological Survey. (1987a). *Hydrogeology and Water Quality of Significant Sand and Gravel Aquifers*. Retrieved August 3, 2015, from http://www.maine.gov/dacf/mgs/pubs/online/water/87-24a.pdf

Maine Geological Survey. (1987b). *Hydrogeology and Water Quality of Significant Sand and Gravel Aquifers*. Retrieved August 3, 2015, from http://www.maine.gov/dacf/mgs/pubs/online/water/87-1a.pdf

Maine Geological Survey. (1988). *Hydrogeology and Water Quality of Significant Sand and Gravel Aquifers*. Retrieved August 3, 2015, from http://www.maine.gov/dacf/mgs/pubs/online/water/88-7a.pdf

Maine Geological Survey. (2002). *Simplified Bedrock Geologic Map of Maine.* Retrieved September 2015, from http://www.maine.gov/dacf/mgs/pubs/online/bedrock/bedrock11x17.pdf

Maine Geological Survey. (2003). *Glacial and Postglacial Geology Highlights in the White Mountain National Forest, Western Maine.* Retrieved June 2015, from https://www1.maine.gov/dacf/mgs/explore/surficial/sites/wmnf.pdf

Maine Geological Survey. (2005a). *Pertica quadrifaria: Maine's State Fossil*. Retrieved June 2015, from http://www.maine.gov/dacf/mgs/explore/fossils/stfossil.htm

Maine Geological Survey. (2005b). *Fossils Preserved in Maine Sediments*. Retrieved June 2015, from http://www.maine.gov/dacf/mgs/explore/fossils/sediment/fossil-sed.htm

Maine Geological Survey. (2005c). *Brachiopod Photo.* Retrieved July 2015, from http://www.maine.gov/dacf/mgs/explore/fossils/bedrock/brach.htm

Maine Geological Survey. (2007a). *Maine's Ice Age Trail*. Retrieved June 2015, from http://www.maine.gov/dacf/mgs/explore/surficial/facts/jul07.pdf

Maine Geological Survey. (2007b). *Review and Recommendations Regarding Ground Water Regulations*. Retrieved July 0, 2015, from http://www.maine.gov/dacf/mgs/explore/water/regs/ld452-intro.htm

Maine Geological Survey. (2008). *Fossils Preserved in Maine Bedrock*. Retrieved June 2015, from http://www.maine.gov/dacf/mgs/explore/fossils/bedrock/fossil-bdrk.htm

Maine Geological Survey. (2012). *Bedrock Geologic History of Maine.* Retrieved June 2015, from http://www.maine.gov/dacf/mgs/explore/bedrock/facts/geol-hist.htm

Maine Geological Survey. (2013). *Virtual Tour of Maine's Fossils*. Retrieved June 2015, from http://www.maine.gov/dacf/mgs/explore/fossils/virtual/virtual_fossils.pdf

Maine Geological Survey. (2014). *Maine Fossils Remains of Life from Another Time and Place*. Retrieved June 2015, from http://www.maine.gov/dacf/mgs/explore/fossils/fossil.htm

Maine Geological Survey. (2015). *Maine's Geologic Hazards.* Retrieved June 2015, from https://www1.maine.gov/dacf/mgs/hazards/virtual/virtual_hazards.pdf

Maine Historic Preservation Commission. (2006). *Prehistoric Archaeology*. Retrieved September 2015, from http://www.state.me.us/mhpc/archaeology/prehistoric_archaeology.html

Maine Land Use Planning Commission. (2007). *Sub-Chapter III, Land Use Standards*. Retrieved July 10, 2015, from http://www.maine.gov/dacf/lupc/laws_rules/rule_chapters/Ch10_SubchapterIII.pdf

Maine Land Use Planning Commission. (2015, July 24). *Wetland Protection Subdistrict (P-WL).* Retrieved September 24, 2015, from http://www.maine.gov/dacf/lupc/laws_rules/rule_chapters/Ch10_SubchapterII.pdf

Maine OFBS. (2015, August). *MaineDOT Office of Frieght and Business Services*. Retrieved July 2015, from MaineDOT: http://www.maine.gov/mdot/ofbs/

Maine Office of the Reviser of Statues. (2015). *Title 38: WATERS AND NAVIGATION: Chapter 3-A: CLIMATE CHANGE HEADING: PL 2003, C. 237, §1 (NEW)*. Retrieved August 20, 2015, from Maine Revised Statues: http://legislature.maine.gov/statutes/38/title38sec576.html

Maine OIT. (2014). *MSCommNet (Radio Network)*. Retrieved Dec 3, 2015, from http://www.maine.gov/oit/services/radio/mscommnet/

Maine OIT. (2015a, Feb). *MSCommNet Operational 2015*. Retrieved Dec 3, 2015, from http://www.maine.gov/tools/whatsnew/index.php?topic=MSCommNet_FAQs&id=642849&v=View

Maine OIT. (2015b, May 26). RegionNet Pocket Guide. *Brochure--MSCommNet*.

Maine Sea Grant. (2015a). *Maine's Climate Future: Coastal Vulnerability to Sea Level Rise.* Retrieved June 2015, from http://umaine.edu/maineclimatenews/files/2011/06/MSG-E-10-04_SeaLevelRise.pdf

Maine Sea Grant. (2015b). *Penobscot Bay.* Retrieved June 29, 2015, from http://www.seagrant.umaine.edu/files/pdf-global/07poster04.pdf

Maine State Legislature. (2015). *Maine State Legislature*. Retrieved 8 10, 2015, from http://legislature.maine.gov/

Maine State Planning Office. (2005). *Comprehensive Planning: A Manual for Maine Communities.* Retrieved June 29, 2015, from https://www1.maine.gov/dacf/municipalplanning/docs/2005manual_highres.pdf

Maine State Planning Office. (2007, December). *Protecting Local Scenic Resources—Community Based Performance Standards.* Retrieved June 23, 2015, from https://www1.maine.gov/dacf/mcp/downloads/scenic/protectinglocalscenicresources_dec07.pdf

Maine State Planning Office. (2008, October). Scenic Assessment Handbook: State Planning Office, Maine Coastal Program. Augusta. Retrieved from https://www1.maine.gov/dacf/mcp/downloads/scenic/ScenicAssessmentRpt_LowRes.pdf

MaineDOT. (2002). *Maine Transportation Facts*. Retrieved July 15, 2015, from http://www.maine.gov/mdot/planningdocs/pdf/fact2002.pdf

MaineDOT. (2009, November 19). *Rail Facts*. Retrieved July 15, 2015, from http://www.maine.gov/mdot/railplan/railfacts.htm

MaineDOT. (2013). *maine.gov*. Retrieved 8 9, 2015, from http://www.maine.gov/mdot/downloadmaps/docs/RailSystem.pdf

MaineDOT. (2015a). *About MaineDOT*. Retrieved July 15, 2015, from http://www.maine.gov/mdot/about/

MaineDOT. (2015b). *Explore Maine - Scenic Byways*. Retrieved July 15, 2015, from http://www.exploremaine.org/byways/

MaineDOT. (2015c, July). *Explore Maine By Ferry*. Retrieved July 2015, from MaineDOT: http://www.maine.gov/mdot/ferry/

MaineDOT. (2015d, July). *FAQs*. Retrieved July 2015, from MaineDOT: http://www.maine.gov/mdot/ferry/faqs/

MaineDOT. (2015e). *Explore Maine Scenic Byways*. Retrieved September 2015, from http://exploremaine.org/byways/

Maloney, T. J., & Barlett, W. P. (2013, November). *Maine - Floods and Droughts.* Retrieved July 2015, from http://md.water.usgs.gov/publications/wsp-2375/me/

MCHT. (2015). *Maine Coastal Heritage Trust: Land Protection, Accomplishments*. Retrieved September 8, 2015, from http://www.mcht.org/land_protection/accomplishments/index.html

MDIFW. (2002). *Fishes of Maine*. (Maine Department of Inland Fisheries and Wildlife) Retrieved from https://www1.maine.gov/ifw/fishing/pdfs/fishesofmaine.pdf

MDIFW. (2005, September). *Maine's Comprehensive Wildlife Conservation Strategy, Ch 4: Key Habitats and Natural Communities*. (Maine Department of Inland Fisheries and Wildlife) Retrieved September 24, 2015, from http://www.maine.gov/ifw/pdfs/reports_chapter4.pdf

MDIFW. (2006). *Wildlife Division Research & Management Report*. (Maine Department of Inland Fisheries and Wildlife) Retrieved from http://www.state.me.us/ifw/wildlife/reports/pdfs/reports_research_2006.pdf

MDIFW. (2012). *Piping Plover and Least Tern Information Sheet*. (Maine Department of Inland Fisheries and Wildlife) Retrieved from http://66.39.75.177/wp-content/uploads/2012/02/PipingPlover-LeastTernInfosheet-2011.pdf

MDIFW. (2013a). *Lands*. (Maine Department of Inland Fisheries and Wildlife) Retrieved September 16, 2015, from http://www.maine.gov/ifw/wildlife/land/index.html

MDIFW. (2013b). *Mammals*. (Maine Department of Inland Fisheries and Wildlife) Retrieved from http://www.maine.gov/ifw/wildlife/species/mammals/

MDIFW. (2013c). *Birds*. (Maine Department of Inland Fisheries and Wildlife) Retrieved from http://www.maine.gov/ifw/wildlife/species/birds/

MDIFW. (2013d). *Upland Game Birds*. (Maine Department of Inland Fisheries and Wildlife) Retrieved Dec 3, 2015, from http://www.maine.gov/ifw/wildlife/species/birds/upland.html

MDIFW. (2013e). *Waterfowl*. (Maine Department of Inland Fisheries and Wildlife) Retrieved Dec 3, 2015, from http://www.maine.gov/ifw/wildlife/species/birds/waterfowl.html

MDIFW. (2013f). *Wading Birds*. (Maine Department of Inland Fisheries and Wildlife) Retrieved Dec 3, 2015, from http://www.maine.gov/ifw/wildlife/species/birds/wading.html

MDIFW. (2013g). *Raptors*. (Maine Department of Inland Fisheries and Wildlife) Retrieved Dec 3, 2015, from http://www.maine.gov/ifw/wildlife/species/birds/raptors.html

MDIFW. (2013h). *Seabirds*. (Maine Department of Inland Fisheries and Wildlife) Retrieved Dec 3, 2015, from http://www.maine.gov/ifw/wildlife/species/birds/seabirds.html

MDIFW. (2013i). *Shorebirds*. (Maine Department of Inland Fisheries and Wildlife) Retrieved Dec 3, 2015, from http://www.maine.gov/ifw/wildlife/species/birds/shorebirds.html

MDIFW. (2013j). *Songbirds*. (Maine Department of Inland Fisheries and Wildlife) Retrieved Dec 3, 2015, from http://www.maine.gov/ifw/wildlife/species/birds/songbirds.html

MDIFW. (2013k). *Invertebrates*. (Maine Department of Inland Fisheries and Wildlife) Retrieved April 1, 2016, from http://www.maine.gov/ifw/wildlife/species/invertebrates/

MDIFW. (2013l). *Freshwater Mussels*. (Maine Department of Inland Fisheries and Wildlife) Retrieved from http://www.maine.gov/ifw/wildlife/species/invertebrates/freshwater_mussels.html

MDIFW. (2013m). *White Nose Syndrome*. (Maine Department of Inland Fisheries and Wildlife) Retrieved Dec 3, 2015, from http://www.maine.gov/ifw/wildlife/disease/white_nose_syndrome.htm

MDIFW. (2015a). *Essential Wildlife Habitat*. (Maine Department of Inland Fisheries and Wildlife) Retrieved from http://www.maine.gov/ifw/wildlife/endangered/essential_habitat/index.html

MDIFW. (2015b). *Recreational Opportunities: Provided by Lands Managed by the Maine Department of Inland Fisheries and Wildlife*. (Maine Department of Inland Fisheries and Wildlife) Retrieved July 1, 2015, from http://www.maine.gov/ifw/wildlife/land/department/recreation.htm

MDMR. (1993). *A Teacher's Guide to Marine Life of the Gulf of Maine*. Retrieved from https://www1.maine.gov/dmr/rm/aquarium/Teachers_Guide.pdf

Merriam Webster Dictionary. (2015a). *Airspace*. Retrieved June 2015, from Merriam Webster Dictionary: http://www.merriam-webster.com/dictionary/airspace

Merriam Webster Dictionary. (2015b). *Sea Level*. Retrieved July 2015, from Merriam Webster Dictionary: http://www.merriam-webster.com/dictionary/sea%20level

MNAP. (2016a). *Natural Communities and Ecosystems*. Retrieved from http://www.maine.gov/dacf/mnap/features/community.htm

MNAP. (2016b). *Ecological Inventory and Monitoring*. Retrieved from http://www.maine.gov/dacf/mnap/features/inventory/index.htm

MNAP. (2016c). *Ecological Reserve System*. Retrieved from Main Natural Areas Program: http://www.maine.gov/dacf/mnap/reservesys/index.htm

MPUC. (2015a, July). *Standard Offer*. Retrieved July 2015, from Maine Public Utilities Commission: http://www.maine.gov/mpuc/electricity/standard_offer/index.shtml

MPUC. (2015b, July). *Retail Electricity Suppliers in Maine*. Retrieved July 2015, from Maine Public Utilities Commission: http://www.maine.gov/mpuc/electricity/list_of_suppliers.shtml

MPUC. (2015c, July). *About MPUC*. Retrieved July 2015, from Maine Public Utilities Commission: http://www.maine.gov/mpuc/about/index.shtml

MPUC. (2015d, July). *Water*. Retrieved 2015 July, from Maine Public Utilities Commission: http://www.maine.gov/mpuc/water/index.shtml

Multiquip. (2015). *MQ POWER 60kW Diesel On-Site Power Industrial Generator.* Retrieved September 21, 2015, from http://www.multiquip.com/multiquip/pdfs/MQP60JD_rev_2_DataId_24320_Version_2.pdf

National Association of State Aviation Officials (NASAO). (2015). *Resources NASAO National Association of State Aviation Officials*. Retrieved July 2015, from NASAO National Association of State Aviation Officials: http://www.nasao.org/Resources.aspx

National Audubon Society. (2015). *Important Bird Areas - Maine*. Retrieved from http://netapp.audubon.org/IBA/State/US-ME

National Conference of State Legislators. (2015, August). *Federal and State Recognized Tribes*. Retrieved August 2015, from http://www.ncsl.org/research/state-tribal-institute/list-of-federal-and-state-recognized-tribes.aspx#ny

National Fire Department Census. (2015, June 11). Retrieved from http://apps.usfa.fema.gov/census-download/main/download

National League of Cities. (2007). (Census of Governments) Retrieved May 21, 2015, from Subcounty, General-Purpose Governments by Population-Size Group and State: http://www.nlc.org/build-skills-and-networks/resources/cities-101/city-structures/number-of-municipal-governments-and-population-distribution

National Wild and Scenic Rivers System. (2015a). *About the WSR Act*. Retrieved April 6, 2015, from New York: http://www.rivers.gov/wsr-act.php

National Wild and Scenic Rivers System. (2015b). *Allagash River, Maine*. Retrieved July 2, 2015, from National Wild and Scenic Rivers System: http://www.rivers.gov/rivers/allagash.php

National Wildlife Federation. (2015). *Ecoregions*. Retrieved July 1, 2015, from http://www.nwf.org/Wildlife/Wildlife-Conservation/Ecoregions.aspx

NCED. (2015). *State of Maine Easements with the Purpose of Environmental System*. Retrieved September 16, 2015, from National Conservation Easement Database: http://conservationeasement.us/reports/easements

NERRS. (2011). *National Estuarine Research Reserve System Strategic Plan*. Retrieved July 15, 2015, from http://coast.noaa.gov/data/docs/nerrs/StrategicPlan2011.pdf

New England Coastal Wildlife Alliance. (2015). *The Gulf of Maine*. Retrieved from http://www.necwa.org/gulf-maine.html

NIH. (2015a, June). *What is TOXMAP?* Retrieved from http://toxmap.nlm.nih.gov/toxmap/faq/2009/08/what-is-toxmap.html

NIST. (2015, March). *Nationwide Public Safety Broadband Network Deployment: Network Parameter Sensitivity Analysis.* U.S. Department of Commerce. National Institute of Standards and Technology (NIST), Wireless Networks Division, Communications Technology Laboratory.

NOAA. (1998, April). *An Evaluation of the Severity of the January 1998 Ice Storm in Northern New England: Report for FEMA Region 1*. Retrieved September 21, 2015, from http://www.erh.noaa.gov/btv/research/USCOE%20IceStorm98.pdf

NOAA. (2000, October). *A Climatology of Recent Extreme Weather and Climate Events.* Retrieved from National Oceanic and Atmospheric Administration: http://www1.ncdc.noaa.gov/pub/data/techrpts/tr200002/tr2000-02.pdf

NOAA. (2006). *Chronological List of All Hurricanes which Affected the Continental United States: 1851 - 2005*. Retrieved from National Oceanic and Atmospheric Administration: http://www.aoml.noaa.gov/hrd/hurdat/ushurrlist.htm

NOAA. (2015a). *Wells National Estuarine Research Reserve*. Retrieved August 6, 2015, from http://nerrs.noaa.gov/reserves/wells.html

NOAA. (2015b). *Flood Related Hazards*. Retrieved July 2015, from http://www.floodsafety.noaa.gov/hazards.shtml

NOAA. (2015c). *Flooding in Maine*. Retrieved July 2015, from http://www.floodsafety.noaa.gov/states/me-flood.shtml

NOAA. (2015d). *Green Turtle (Chelonia mydas)*. Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/green.htm

NOAA. (2015e). *Hawksbill Sea Turtle (Eretmochelys imbricata)*. Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/hawksbill.htm

NOAA. (2015f). *Leatherback Turtle (Dermochelys coriacea)*. Retrieved from http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.htm

NOAA. (2015g). *National Centers of Environmental Information*. Retrieved from National Centers of Environmental Information: http://www.ncdc.noaa.gov/cag/time-series/us

NOAA. (2015h). *National Oceanic and Atmospheric Administration*. Retrieved from Data Tools: 1981 - 2010 Normals: http://www.ncdc.noaa.gov/cdo-web/datatools/normals

NOAA. (2015i, June). *Hurricane Research Division*. Retrieved from National Oceanic and Atmospheric Administration: http://www.aoml.noaa.gov/hrd/tcfaq/E19.html

NOAA. (2016a). *Essential Fish Habitat Mapper v3.0*. (National Ocean and Atmospheric Administration National Marine Fisheries Service) Retrieved April 1, 2016, from http://www.habitat.noaa.gov/protection/efh/habitatmapper.html

NOAA. (2016b, March). *Atlantic salmon*. Retrieved from http://www.fisheries.noaa.gov/pr/species/fish/atlantic-salmon.html

NOAA; USGS; SERPD; and USACE. (2012). *Global Sea Level Rise Scenarios for the.* MD: Silver Springs.

NPCA. (2016). *NCPA Northeast* . Retrieved February 16, 2016, from https://www.npca.org/regions/northeast#parks

NPS. (2000). *Geologic Glossary*. Retrieved August 2015, from https://www.nature.nps.gov/geology/usgsnps/misc/glossaryDtoI.html#G

NPS. (2004). *Rocky Mountain National Park: Geologic Resource Evaluation Report.* Retrieved from http://www.9-11commission.gov/report/911Report.pdf

NPS. (2012a, June 28). *Maine*. Retrieved September 16, 2015, from National Natural Landmarks Program: http://www.nature.nps.gov/nnl/state.cfm?State=ME

NPS. (2012b, July 17). *The National Trails System Act*. Retrieved April 12, 2015, from http://nature.nps.gov/nnl/index.cfm

NPS. (2013, December 10). *Geologic Hazards*. Retrieved September 1, 2015, from Geologic, Energy, and Mineral Resources: http://www.nature.nps.gov/geology/hazards/

NPS. (2014a, June 19). *Policy Memorandum 14-05, Unmanned Aircraft – Interim Policy.* Retrieved June 2015, from http://www.nps.gov/nr/research/

NPS. (2014b, October 22). *National Natural Landmarks Program*. Retrieved April 21, 2015, from http://nature.nps.gov/nnl/index.cfm

NPS. (2014c, September). *Maine*. Retrieved June 2015, from http://www.nps.gov/state/ME/index.htm

NPS. (2014d, 06 16). *National Park Service Science of Sound*. Retrieved 07 22, 2015, from http://www.nature.nps.gov/sound/science.cfm

NPS. (2015a). *Acadia National Park*. Retrieved September 2015, from http://www.nps.gov/acad/index.htm

NPS. (2015b, June 29). *National Park Service: Maine: Maine Parks*. Retrieved June 29, 2015, from http://www.nps.gov/state/me/index.htm

NPS. (2015c, April 27). *National Historic Landmarks Program*. Retrieved April 28, 2015, from http://www.nps.gov/nhl/INDEX.htm

NPS. (2015d, April 15). *National Historic Landmarks Survey: National Park Service: Listing of National Historic Landmarks By States.* Retrieved June 30, 2015, from National Historic Landmarks Program: National Historic Landmarks in Maine: http://www.nps.gov/nhl/find/statelists/me.htm

NPS. (2015e, June 30). *National Park Service: Saint Croix Island*. Retrieved June 30, 2015, from http://www.nps.gov/sacr/index.htm

NPS. (2015f, June 30). *National Park Service: Maine Acadian Culture*. Retrieved June 30, 2015, from http://www.nps.gov/maac/index.htm

NPS. (2015g, September 8). *National Park Service: Photo Gallery, Maine Acadian Culture*. Retrieved September 8, 2015, from http://www.nps.gov/media/photo/gallery.htm?maxrows=20&id=1C337C5A-155D-451F-6706C1E6CAFE45F9&tagid=0&showrawlisting=false&startrow=41

NPS. (2015h, July 1). *National Park Service: Acadia National Park: Land Resources*. Retrieved July 1, 2015, from http://www.nps.gov/acad/learn/management/rm_landresources.htm

NPS. (2015i, September 8). *National Park Service: Acadia National Park, Photo Gallery, Seasons*. Retrieved September 8, 2015, from http://www.nps.gov/media/photo/gallery.htm?id=F810EE82-155D-451F-67D336A09FC76A3F

NPS. (2015j). *Wilderness*. Retrieved September 2015, from http://wilderness.nps.gov/faqnew.cfm

NPS. (2015k, June 28). *Maine National Natural Landmarks Program*. Retrieved August 6, 2015, from http://www.nature.nps.gov/nnl/state.cfm?state=ME

NPS. (2015l). *National Register of Historic Places Program: Fundamentals*. Retrieved September 23, 2015, from http://www.nps.gov/nr/national_register_fundamentals.htm

NPS. (2015m). *National Register of Historic Places*. Retrieved February 11, 2015, from http://www.nps.gov/nr/

NPS. (2015n). *National Heritage Areas: A Map of All the National Heritage Areas*. Retrieved May 2015, from National Park Service: http://www.nps.gov/maps/full.html?mapId=01a03739-ab0c-40eb-bc3d-6791d3bb67fa

NPS. (2015o). *Maine National Park Service*. Retrieved 8 9, 2015, from http://www.nps.gov/state/me/index.htm

NPS. (2016a, February). *Maine National Parks*. Retrieved June 2015, from http://www.nps.gov/state/me/index.htm

NPS. (2016b). *National NAGPRA Online Databases*. Retrieved March 17, 2016, from http://grantsdev.cr.nps.gov/Nagpra/NACD/NACD_Search_Page_Query_Results.cfm

NRCS. (1996a). *Soil Quality Resource Concerns: Soil Erosion*. Retrieved September 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051278.pdf

NRCS. (1996b). *Soil Quality Resource Concerns: Compaction*. Retrieved September 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051594.pdf

NRCS. (1999). *Soil Taxonomy A Basic System of Soil Classification for Making and Interpreting Soil Surveys.* Retrieved from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051232.pdf

NRCS. (2003). *Soil Compaction: Detection, Prevention, and Alleviation*. Retrieved September 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053258.pdf

NRCS. (2006). *Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin.* Retrieved May 2015, from Major Land Resource Area: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051845.pdf

NRCS. (2015a). *What is Soil?* Retrieved June 2015, from Soil Education: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/edu/?cid=nrcs142p2_054280

NRCS. (2015b). *Using Soil Taxonomy to Identify Hydric Soils*. Retrieved Nov 16, 2015, from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_010785.pdf

NRCS. (2015c). *STATSGO2 Database.* Retrieved June 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053629

NRCS. (2015d). *Twelve Orders of Soil Taxonomy*. Retrieved August 2015, from Soils: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053588

NRCS. (2015e). *Erosion*. Retrieved September 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/landuse/crops/erosion/

NRCS. (2015f). *Hydric Soils -- Introduction.* Retrieved June 2015, from http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961

NTFI. (2005). *Why Can't We Talk? Working Together to Bridge the Communications Gap to Save Lives: A Guide for Public Officials.* U.S. Department of Justice, Office of Justice Programs, National Institute of Justice. National Task Force on Interoperability (NTFI).

NTIA. (2005, October). *Interference Protection Criteria Phase 1 - Compilation from Existing Sources.* Retrieved January 6, 2016, from NTIA Report 05-432: https://www.ntia.doc.gov/files/ntia/publications/ipc_phase_1_report.pdf

NTIA. (2014). *Download Data.* Retrieved from National Broadband Map: http://www.broadbandmap.gov/data-download

NWS. (2011a). *National Weather Service: JetStream - Online School for Weather*. Retrieved from National Oceanic and Atmospheric Administration: http://www.srh.noaa.gov/jetstream//global/climate.htm#map

NWS. (2011b, October 21). *National Weather Service: JetStream - Online School for Weather*. Retrieved from National Oceanic and Atmospheric Administration: http://www.srh.noaa.gov/jetstream//global/climate_max.htm

NWS. (2015a). *National Weather Service*. Retrieved from National Oceanic and Atmospheric Administration: http://www.weather.gov/car/summer2014climate

NWS. (2015b). *Flooding in Maine*. Retrieved from National Oceanic and Atmospheric Administration: http://www.floodsafety.noaa.gov/states/me-flood.shtml

NWS. (2015c, June 10). *Office of Climate, Water, and Weather Services*. Retrieved September 9, 2015, from 2014 Summary of Hazardous Weather Fatalities, Injuries, and Damage by State: http://www.nws.noaa.gov/om/hazstats/state14.pdf

NYOEM. (2015). *New York City Office of Emergency Management*. Retrieved from NYC Hazards: Coastal Storms and Hurricanes: http://www.nyc.gov/html/oem/html/hazards/storms_hurricanehistory.shtml

Office of Comprehensive Planning, Maine Department of Economic and Community Development. (1988, December). Guidelines for Maine's Growth Management Program. Augusta.

Olcott, P. G. (1995). *Carbonate-Rock Aquifers, HA 730-M*. Retrieved May 5, 2015, from http://pubs.usgs.gov/ha/ha730/ch_m/M-text4.html

Oregon Department of Geology. (2015). *Earthquake Hazards in the Pacific Northwest*. Retrieved March 2015, from http://www.oregongeology.org/sub/earthquakes/EQs.htm

OSHA. (2002). *Occupational Safety & Health Administration We Can Help*. Retrieved from Hearing Conservation: https://www.osha.gov/Publications/OSHA3074/osha3074.html

OSHA. (2003). *Fact Sheets on Natural Disaster Recovery: Flood Cleanup.* Retrieved December 2013, from https://www.osha.gov/OshDoc/data_Hurricane_Facts/Bulletin2.pdf

OSHA. (2013). *OSHA Technical Manual - Noise.* Washington, D.C.: OSHA. Retrieved from https://www.osha.gov/dts/osta/otm/new_noise/index.pdf

OSHA. (2015a). *Communication Towers*. Retrieved from https://www.osha.gov/doc/topics/communicationtower/index.html

OSHA. (2015b). *Occupational Safety & Health Administration We Can Help*. (S. L. OSHA Directorate of Technical Support and Emergency Management, & U. Salt Lake City, Editors) Retrieved September 22, 2015, from Safety & Health Management System Tools: https://www.osha.gov/SLTC/etools/safetyhealth/comp3.html#Safe Work Practices

OSHA. (2016a, March 28). *Regulations (Standards - 29 CFR)*. Retrieved from Occupational Safety & Health Administration: https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9867

OSHA. (2016b). *Restoring Communications Systems*. Retrieved February 16, 2016, from Infrastructure Repair and Restoration: https://www.osha.gov/SLTC/etools/hurricane/communications.html

Page, S. D. (2012, October 15). Timely Processing of Prevention of Significant Deterioration (PSD) Permits when EPA or a PSD-Delegated Air Agency Issues the Permit. Retrieved April 21, 2015, from http://www.epa.gov/region7/air/nsr/nsrmemos/timely.pdf

Pauketat, T. R. (2012). *The Oxford Handbook of North American Archaeology.* New York, New York: Oxford University Press, Inc.

Peterson, J. B., Robinson, B. S., Belknap, D. F., Stark, J., & Kaplan, L. K. (1994). An Archaic and Woodland Fish Weir Complex in Central Maine. *Archaeology of Eastern North*

America,, 22, 197-222. Retrieved September 2015, from http://www.jstor.org/stable/40914382

Petrides, G. A. (1986). *Peterson Field Guides: Trees and Shrubs, 1st Edition.*

Portland International Jetport. (2015). *Airport Statistics*. Retrieved July 15, 2015, from http://www.portlandjetport.org/about_the_portland_international_jetport/statistics

ProximityOne. (2015). *State Population Projections, Outlook 2030*. Retrieved March 2015, from https://proximityone.wordpress.com/2013/12/19/state-population-projections-2030/

PSCR. (2015). *Location-Based Services R&D Roadmap.* U.S. Department of Commerce, National Institute of Standards and Technology (NIST), Public Safety Communications Research (PSCR). Retrieved from http://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.1883.pdf

Purdue University. (2015). *Hydrologic Soil Groups.* Retrieved June 2015, from https://engineering.purdue.edu/mapserve/LTHIA7/documentation/hsg.html

Radio Services Operations Department State of Maine. (2015). MSCommNet map of Tower Sites.

RGGI. (2015, September). *RGGI Fact Sheet*. Retrieved April 1, 2016, from Regional Greenhouse Gas Initiative: http://www.rggi.org/docs/Documents/RGGI_Fact_Sheet.pdf

Robbins, R. R. (2012). *Bangor Climate*. Retrieved from http://bangorinfo.com/climate.html

Robinson, F. W. (2011). The Thurman Station Site: A Probable Late Paleoindian Ceremonial Artifact Deposit in the Lake George Region of New York. *Archaeology of Eastern North America, 39*, 67-92. Retrieved September 2015, from http://www.jstor.org/stable/23265115

Rogers, D. J., Olshansky, R., & Rogers, B. R. (2004). *Damage to Foundations From Expansive Soils*. Retrieved March 23, 2015, from http://web.mst.edu/~rogersda/expansive_soils/DAMAGE%20TO%20FOUNDATIONS%20FROM%20EXPANSIVE%20SOILS.pdf

Roosevelt Campobello International Park. (2015). *Roosevelt Campobello International Park: Park Overview*. Retrieved July 1, 2015, from http://www.fdr.net/about-the-park.php

Sacramento County Airport System. (2015). *Sacramento County Airport System Noise Page*. Retrieved 6 10, 2015, from http://www.sacramento.aero/scas/environment/noise/noise_101/

Sanger, D. (2008). Discerning Regional Variation: The Terminal Archaic Period in the Quoddy Region of the Maritime Peninsula. *Canadian Journal of Archaeology / Journal Canadien d'Archéologie, 32*(1), 1-42. Retrieved September 2015, from http://www.jstor.org/stable/41103603

Sassaman, K. E. (1998). Distribution, Timing, and Technology of Early Pottery in the Southeastern United States. *Revista de Arqueologia American , 14*, 101-103, 105-133. Retrieved August 2015, from http://www.jstor.org/stable/27768403

SCEC. (2015). *National Oceanic and Atmospheric Administration*. Retrieved from State Climate Extremes Committee: http://www.ncdc.noaa.gov/extremes/scec/records

Searsport Maine. (2015, July). *Searsport Port*. Retrieved July 2015, from Searsport Maine: http://www.searsport.maine.gov/index.asp?SEC=65CA2B27-B601-423B-B7CE-2765CD293C03&Type=B_BASIC

Society, M. H. (2016). Native Species - Snakes. *Native Species - Snakes*. Retrieved from http://www.maineherp.org/index.php?display=native_species&show=snakes

Southall et al. (2007). Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals,* 411-521. Retrieved from http://sea-inc.net/assets/pdf/mmnoise_aquaticmammals.pdf

Spiess, A. (1990). Two Isolated Paleoindian Artifacts from Maine. *Archaeology of Eastern North America, 18*, 65-74. Retrieved September 2015, from http://www.jstor.org/stable/40914319

Spiess, A., & Hedden, M. (2000). A Small Paleoindian Site in the Western Maine Foothills . *Archaeology of Eastern North America, 28*, 63-79. Retrieved September 2015, from http://www.jstor.org/stable/40914438

State of Maine. (2008, January 4). *The Ice Storm of 1998 Remembered.* Retrieved September 22, 2015, from Main Prepares: http://www.state.me.us/mema/prepare/prep_news.shtml?id=48008#.VgD_kbEo5Ms

State of Maine. (2012). *Statewide Communication Interoperability Plan (SCIP) Implementation Report.* Update SCIP Implementation Report.

State of Maine. (2015, March 19). *Spring Flood Risk Frozen*. Retrieved from State of Maine, Maine Prepares: http://www.state.me.us/mema/prepare/prep_news.shtml?id=640345#.VcJgHflViko

State of Maine. (2016, January 15). *Maine Secretary of State Kids - All About Maine*. Retrieved March 17, 2016, from http://maine.gov/sos/kids/about/index.htm

State of Maine Emergency Services Communication Bureau. (2015, July 21). *maine911.com*. Retrieved 2015, from http://www.maine911.com/psap/index.htm

Telecommunications Industry Association. (2013, May 13). *Electronic Comment Filing System.* Retrieved from Federal Communications Commission: http://apps.fcc.gov/ecfs/comment/view?id=6017340269

The Appalachian Trail Conservancy. (2015). *Terrain by State: Maine*. Retrieved September 2015, from http://www.appalachiantrail.org/about-the-trail/terrain-by-state/maine

The Maine Archaeological Society. (2009). *Home Page*. Retrieved February 2016, from http://mainearchsociety.org/

The University of Maine. (2015). *Maine Invasive Species Network - Identification Resources (Insects, Marine and Fish)*. Retrieved from http://umaine.edu/invasivespecies/home/id_resources/

Thompson (Ed.). (1976). *Maine Forms of American Architecture.* Waterville: Colby College Museum of Art.

Thompson, W. (2015). *Surficial Geology Handbook for Southern Maine.* Retrieved July 2015, from http://www.maine.gov/dacf/mgs/explore/surficial/sghandbook/surficial_geology_handbook_for_southern_maine.pdf

Tiner, R. W. (2010). *Wetlands of the Northeast: Results of the National Wetlands Inventory*. Retrieved April 6, 2015, from U.S. Fish and Wildlife Service, Northeast Region, Hadley, MA: http://www.fws.gov/northeast/pdf/Northeast_Wetlands_Final_Report.pdf

Toppan, F. (1935). *The Physiography of Maine.* Retrieved June 2015, from http://www.jstor.org/stable/30056075?seq=1#page_scan_tab_contents

U.S. Bureau of Justice Statistics . (2011, July 26). *Census of State and Local Law Enforcement Agencies*. Retrieved from http://www.bjs.gov/index.cfm?ty=pbdetail&iid=2216

U.S. Bureau of Labor Statistics. (2012). *Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2012 (Maine).* Retrieved September 22, 2015, from http://www.bls.gov/iif/oshwc/osh/os/pr126me.pdf

U.S. Bureau of Labor Statistics. (2013a). *Incidence rate and number of nonfatal occupational injuries by industry and ownership, 2013 (U.S.).* Retrieved September 22, 2015, from http://www.bls.gov/iif/oshwc/osh/os/ostb3966.pdf

U.S. Bureau of Labor Statistics. (2013b). *Fatal occupational injuries to private sector wage and salary workers, government workers, and self-employed workers by industry, all United States,*. Retrieved September 22, 2015, from http://www.bls.gov/iif/oshwc/cfoi/cftb0279.pdf

U.S. Bureau of Labor Statistics. (2013c). *Incidence rates of nonfatal occupational injuries and illnesses by industry and case types, 2013 (Maine).* Retrieved September 22, 2015, from http://www.bls.gov/iif/oshwc/osh/os/pr136me.pdf

U.S. Bureau of Labor Statistics. (2013d). *Injuries, Illnesses, and Fatalities*. Retrieved September 8, 2015, from Fatal occupational injuries in Maine: http://www.bls.gov/iif/oshwc/cfoi/tgs/2013/iiffw23.htm

U.S. Bureau of Labor Statistics. (2013e, April 25). *Fatal occupational injuries by industry and event or exposure, All U.S., 2011*. Retrieved September 22, 2015, from http://www.bls.gov/iif/oshwc/cfoi/cftb0259.pdf

U.S. Bureau of Labor Statistics. (2015a, March 25). *Bureau of Labor Statistics*. Retrieved May 2015, from Occupational Employment Statistics: http://www.bls.gov/oes/current/oes_nm.htm

U.S. Bureau of Labor Statistics. (2015b). *Local Area Unemployment Statistics, Employment status of the civilian noninstitutional population, 1976 to 2014 annual averages.* Retrieved April 2015, from http://www.bls.gov/lau/rdscnp16.htm

U.S. Bureau of Labor Statistics. (2015c, March 25). *Occupational Employment and Wages, May 2014: 49-9052 Telecommunications Line Installers and Repairers.* Retrieved from http://www.bls.gov/oes/current/oes499052.htm

U.S. Bureau of Labor Statistics. (2015d, March 25). *Occupational Employment and Wages, May 2014: 49-2022 Telecommunications Equipment Installers and Repairers, Except Line Installers.* Retrieved September 8, 2015, from http://www.bls.gov/oes/current/oes492022.htm

U.S. Bureau of Labor Statistics. (2015e, September 17). *Fatal occupational injuries by industry and event or exposure, all United States, 2014.* Retrieved September 22, 2015, from http://www.bls.gov/iif/oshwc/cfoi/cftb0286.pdf

U.S. Bureau of Labor Statistics. (2015f, November 19). *Schedule of upcoming releases and access to archived news releases*. Retrieved February 16, 2016, from Injuries, Illnesses, and Fatalities: http://www.bls.gov/iif/osh_nwrl.htm

U.S. Census Bureau. (2006). *Government Finance and Employment Classification Manual.* 2006_classification_manual. Retrieved July 2015, from http://www2.census.gov/govs/pubs/classification/2006_classification_manual.pdf

U.S. Census Bureau. (2010). *2010 Census Urban and Rural Classification and Urban Area Criteria*. Lists of 2010 Census Urban Areas: A national, state-sorted list of all 2010 urbanized areas and urban clusters for the U.S., Puerto Rico, and Island Areas first sorted by state FIPS code, then sorted by UACE code. Retrieved June 2015, from http://www2.census.gov/geo/docs/reference/ua/ua_st_list_all.xls

U.S. Census Bureau. (2012a). *Census Fact Finder*. Retrieved from Local Governments by Type and State from 2012: http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF

U.S. Census Bureau. (2012b). *Maine: 2010*. Retrieved August 4, 2015, from http://www.census.gov/prod/cen2010/cph-2-21.pdf

U.S. Census Bureau. (2012c). *2010 Census Urban and Rural Classification and Urban Area Criteria.* Retrieved June 2015, from http://www2.census.gov/geo/docs/reference/ua/ua_st_list_all.xls

U.S. Census Bureau. (2015a). *2010 Census Summary File 1, Table GCT-PH1, Population, Housing Units, Area, and Density.* Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=DEC_10_SF1_GCTPH1.US01PR&prodType=table

U.S. Census Bureau. (2015b, May 28). *U.S. Census Bureau*. Retrieved May 21, 2015, from State and County Quickfacts: http://quickfacts.census.gov/qfd/states/23000.html

U.S. Census Bureau. (2015c). *Annual Estimates of the Resident Population: April 1, 2010 to July 1, 2014.* Washington, D.C.: US. Census Bureau, Population Division.

U.S. Census Bureau. (2015d, March 11). *Foreign Trade*. Retrieved July 2015, from United States Census Bureau: http://www.census.gov/foreign-trade/Press-Release/2013pr/12/ft920/index.html

U.S. Census Bureau. (2015e). *Population Estimates Program, 2010-2014 Data.* Retrieved March 2015, from http://www.census.gov/popest/data/national/totals/2014/files/NST-EST2014-alldata.pdf

U.S. Census Bureau. (2015f). *Resident Population of the 50 States, the District of Columbia, and Puerto Rico: Census 2000.* Retrieved March 2015, from https://www.census.gov/population/www/cen2000/maps/respop.html

U.S. Census Bureau. (2015g). American Community Survey, 2009-2013 5-Year Summary File, Table B02001, Race. Retrieved April 2015, from http://dataferrett.census.gov/

U.S. Census Bureau. (2015h). *2010 Census Urban and Rural Classification and Urban Area Criteria.* Retrieved June 2015, from http://www.census.gov/geo/reference/ua/urban-rural-2010.html

U.S. Census Bureau. (2015i). Census 2000 Summary File 1 (SF 1), Table P001, Total Population. Retrieved July 2015, from http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t

U.S. Census Bureau. (2015j). American Community Survey, 2009-2013 5-Year Estimates, Table DP05, Demographic and Housing Estimates. Retrieved August 2015, from http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml

U.S. Census Bureau. (2015k). *Small Area Income and Poverty Estimates (SAIPE), 2013.* Retrieved March 2015, from http://www.census.gov/did/www/saipe/data/statecounty/data/2013.html

U.S. Census Bureau. (2015l). American Community Survey, 2013 1-Year Estimates, Table DP02, Selected social characteristics. Retrieved April 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP02&prodType=table

U.S. Census Bureau. (2015m). American Community Survey, 2013 1-Year Estimates, Table S1902, Mean Income in the Past 12 Months (in 2013 Inflation-Adjusted Dollars). Retrieved April 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_S1902&prodType=table

U.S. Census Bureau. (2015n). *American Community Survey and Puerto Rico Community Survey 2013 Subject Definitions.* Retrieved April 2015, from http://www2.census.gov/programs-surveys/acs/tech_docs/subject_definitions/2013_ACSSubjectDefinitions.pdf

U.S. Census Bureau. (2015o). *2009-2013 American Community Survey 5-Year Estimates, Table DP03: Selected economic characteristics*. (Obtained via Census Bureau online American FactFinder tool) Retrieved April, July 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_DP03&prodType=table

U.S. Census Bureau. (2015p). *American Community Survey, 2013 1-year Estimates, Table DP03, Selected economic characteristics*. (Obtained via Census Bureau online American FactFinder tool) Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP03&prodType=table

U.S. Census Bureau. (2015q). *American Community Survey, 2013 1-Year Estimates, Table DP04, Selected housing characteristics*. (Obtained via Census Bureau online American FactFinder tool) Retrieved April 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_1YR_DP04&prodType=table

U.S. Census Bureau. (2015r). *American Community Survey*, *2009-2013 5-year Estimates, Table DP04, Selected housing characteristics*. (Obtained via Census Bureau online American FactFinder tool) Retrieved April, July 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_DP04&prodType=table

U.S. Census Bureau. (2015s). 2012 Census of Governments: Finance – Surveys of State and Local Government Finances, Table LGF001. Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=COG_2012_LGF001&prodType=table

U.S. Census Bureau. (2015t). American Community Survey, 2012 1-Year Estimates, Table B01003: Total Population. Retrieved June 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_1YR_B01003&prodType=table

U.S. Census Bureau. (2015u). American Community Survey, 2013 1-Year Estimates, Table DP05, Demographic and Housing Estimates. Retrieved August 31, 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_DP05&prodType=table

U.S. Census Bureau. (2015v). American Community Survey, 2013 1-Year Estimates, Table S1701: Poverty Status in the Past 12 Months. Retrieved August 31, 2015, from http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_1YR_S1701&prodType=table

U.S. Census Bureau. (2015w). American Community Survey, 2009-2013 5-Year Summary File, Table B02001, Race. Retrieved April 2015, from http://dataferrett.census.gov/

U.S. Census Bureau. (2015x). American Community Survey, 2009-2013 5-Year Summary File, Table B03002, Hispanic or Latino Origin by Race. Retrieved April 2015, from http://dataferrett.census.gov

U.S. Census Bureau. (2015y). American Community Survey, 2009-2013 5-Year Summary File, Table B17021, Poverty Status of Individuals in the Past 12 Months by Living Arrangement. Retrieved April 2015, from http://dataferrett.census.gov

U.S. Census Bureau. (2015z). American Community Survey, 2009-2013 5-Year Summary File, Table C17002, Ratio of Income to Poverty Level in the Past 12 Months. Retrieved May 2015, from http://dataferrett.census.gov

U.S. Coast Guard. (2015, September 22). *National Response Center (2015 Reports).* Retrieved September 22, 2015, from http://www.nrc.uscg.mil/FOIAFiles/Current.xlsx

U.S. Department of Commerce. (2013, February 21). *Department of Commerce Environmental Justice Strategy.* Retrieved July 2015, from http://open.commerce.gov/sites/default/files/DOC_Environmental_Justice_Strategy.pdf

U.S. Department of Energy. (2015). *Climate Change and the U.S. Energy Sector: Regional Vulnerabilities and Resilience Solutions.* Washington, DC: Department of Energy. Retrieved December 15, 2015

U.S. Department of Interior. (2008). *Navajo Reservoir RMP/FEA Appendix E Noise*. Retrieved 07 22, 2015, from https://www.usbr.gov/uc/envdocs/ea/navajo/appdx-E.pdf

U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement. (2015, May 26). Abandoned Mine Land Inventory System (e-AMLIS) State and Tribal Summary. Retrieved September 26, 2015, from http://amlis.osmre.gov/Summaries.aspx

U.S. Department of Transportation. (2015a). *FHWA Route Log and Finder List*. Retrieved July 1, 2015, from Federal Highway Administration: http://www.fhwa.dot.gov/reports/routefinder/#s09

U.S. Department of Transportation. (2015b). *National Transportation Atlas Database*. Retrieved July 2015, from Bureau of Transportation Statistics National Transportation Atlas Database: http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_atlas_database/index.html

U.S. Government Publishing Office. (2010, April 5). Title 40 Code of Federal Regulations Part 93.153. Retrieved July 20, 2015, from http://www.ecfr.gov/cgi-bin/text-idx?SID=2028b268447f0bf79b396678569dac85&mc=true&node=se40.20.93_1153&rgn=div8

U.S. Government Publishing Office. (2015, June). *Electronic Code of Federal Regulations.* Retrieved June 2015, from U.S. Government Publishing Office: http://www.ecfr.gov/cgi-bin/text-idx?SID=6095c0db6bb5edb10c850334725dae34&mc=true&tpl=/ecfrbrowse/Title36/36tab_02.tpl

U.S. Harbors. (2015, Nov). *Tides, Weather, & Local Knowledge*. Retrieved Nov 23, 2015, from http://me.usharbors.com

U.S. Legal. (2015). *Noxious-Weed Seeds Law & Legal Definition*. Retrieved from http://definitions.uslegal.com/n/noxious-weed-seeds/

University of Minnesota. (2001). *Soils and Landscapes of Minnesota*. Retrieved July 2015, from http://www.extension.umn.edu/agriculture/tillage/soils-and-landscapes-of-minnesota/

USACE. (2014). *Proposed Department of the Army New England General Permits for Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont*. Retrieved August 5, 2015, from http://www.nae.usace.army.mil/Portals/74/docs/regulatory/publicnotices/NAE-2013-00714%20.pdf

USDA. (2000, March). *Soil Quality - Urban Technical Note No. 1*. Retrieved from Erosion and Sedimentation on Construction Sites: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_053285.pdf

USDA. (2012). *Table 8. Land: 2012 and 2007*. Retrieved April 2015, from http://www.agcensus.usda.gov/Publications/2012?Full Report/Volume 1, Chapter 1 State Level/Maine

USDA. (2014). *Federal Noxious Weed List*. Retrieved from http://www.aphisusda.gov/plant_health/plant_pest_info/weeds/downloads/weedlist.pdf

USDA. (2015). *Ecoregions of the United States*. Retrieved July 1, 2015, from http://www.fs.fed.us/rm/ecoregions/products/map-ecoregions-united-states/#

USEPA. (1973, July 27). *EPA.gov*. Retrieved 08 05, 2015, from National Service Center for Environmental Publications - Impact Characterization of Noise: http://nepis.epa.gov/Exe/ZyNET.exe/9101DPQN.TXT?ZyActionD=ZyDocument&Client=EPA&Index=Prior+to+1976&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&F

USEPA. (1974). *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. Washington, D.C.: EPA.

USEPA. (1992, October 19). Clarification of Prevention of Significant Deterioration (PSD) Guidance for Modeling Class I Area Impacts, Environmental Protection Agency. Retrieved April 21, 2015, from http://www.epa.gov/region7/air/nsr/nsrmemos/class1.pdf

USEPA. (1995a). *Planning for Sea Level Rise.* Retrieved June 2015, from http://papers.risingsea.net/federal_reports/maine_1.pdf

USEPA. (1995b). *America's wetlands: Our vital link between land and water*. Retrieved April 21, 2015, from U.S. Environmental Protection Agency, EPA843-K-95-001: http://water.epa.gov/type/wetlands/fish.cfm

USEPA. (2008, November). *Former Mill Redeveloped to Create 500 Jobs*. Retrieved from http://www.epa.gov/brownfields/success/brewer_me_ss.pdf

USEPA. (2010, March 24). Revisions to the General Conformity Regulations. Retrieved April 20, 2015, from : http://www3.epa.gov/airquality/genconform/documents/20100324rule.pdf

USEPA. (2011a, August 19). Taking Toxics Out of the Air. Part 1 - Main Body of Brochure. Retrieved April 20, 2015, from http://www.epa.gov/air/toxicair/takingtoxics/p1.html

USEPA. (2011b, December 12). *CERCLA Overview*. Retrieved from EPA Superfund: http://www.epa.gov/superfund/policy/cercla.htm

USEPA. (2012a). *Water: Estuaries and Coastal Watersheds*. Retrieved April 5, 2015, from Basic Information about Estuaries: http://water.epa.gov/type/oceb/nep/about.cfm

USEPA. (2012b, November 01). *Fact Sheet - Managing Ozone Air Quality: Findings on Failure to Submit Elements of 1997 Ozone NAAQS State Implementation Plan*. Retrieved July 21, 2015, from http://www.epa.gov/groundlevelozone/fs20080317.html

USEPA. (2012c, May 2012). List of 156 Mandatory Class I Federal Areas. Retrieved April 20, 2015, from http://www.epa.gov/visibility/class1.html

USEPA. (2012d, July 16). *Noise Pollution*. Retrieved August 4, 2015, from http://www.epa.gov/air/noise.html

USEPA. (2012e). *Climate Change Indicators in the United States 2012.* Retrieved October 2013, from http://www.epa.gov/climatechange/pdfs/climateindicators-full-2012.pdf

USEPA. (2013a, August 13). General Conformity. Retrieved April 20, 2015, from http://www.epa.gov/air/genconform/

USEPA. (2013b, August 29). Guidance for Indian Tribes Seeking Class I Redesignation of Indian Country Pursuant to Section 164(c) of the Clean Air Act. Retrieved April 20, 2015, from http://www.epa.gov/air/tribal/pdfs/GuidanceTribesClassIRedesignationCAA.pdf

USEPA. (2013c). *Primary Distinguishing Characteristics of Level III Ecoregions of the Continental United States*. Retrieved from http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm

USEPA. (2014a). *The Impact of Climate Change on the Mid-Atlantic Region.* Retrieved June 2015, from http://www.epa.gov/reg3artd/globclimate/ccimpact.html

USEPA. (2014b). *Region 2 Sole Source Aquifers*. Retrieved April 6, 2015, from Sole Source Aquifers: http://www.epa.gov/region02/water/aquifer/

USEPA. (2014c). *Sole Source Aquifer Program*. Retrieved August 6, 2015, from http://www.epa.gov/region1/eco/drinkwater/pc_solesource_aquifer.html

USEPA. (2014d, October 28). Who Has to Obtain a Title V Permit. Retrieved April 20, 2015, from http://www.epa.gov/airquality/permits/obtain.html

USEPA. (2014e, October). *2013 TRI Analysis: State - Maine*. Retrieved from http://iaspub.epa.gov/triexplorer/tri_factsheet.factsheet_forstate?&pstate=ME&pyear=2013&pDataSet=TRIQ1

USEPA. (2014f). *Grants and Programs*. Retrieved July 2015, from http://www.epa.gov/compliance/environmentaljustice/grants/index.html

USEPA. (2014g, October 21). National Ambient Air Quality Standards (NAAQS). Retrieved April 20, 2015, from http://www.epa.gov/ttn/naaqs/criteria.html

USEPA. (2015a). *Maine Water Quality Assessment Report*. Retrieved August 6, 2015, from http://ofmpub.epa.gov/waters10/attains_state.control?p_state=ME

USEPA. (2015b). *Watershed Assessment, Tracking, and Environmental Results*. Retrieved July 6, 2015, from http://iaspub.epa.gov/waters10/attains_impaired_waters.impaired_waters_list?p_state=ME&p_cycle=2010

USEPA. (2015c). *Level III and Level IV Ecoregions of the Continental United States*. Retrieved from http://www.epa.gov/wed/pages/ecoregions/level_iii_iv.htm#Level III

USEPA. (2015d). *Environmental Justice*. Retrieved July 2015, from http://www.epa.gov/compliance/environmentaljustice/index.html

USEPA. (2015e). *EJSCREEN: Environmental Justice Screening and Mapping Tool*. Retrieved July 2015, from http://www2.epa.gov/ejscreen

USEPA. (2015f, July 14). *Air Permits*. Retrieved July 14, 2015, from http://www.epa.gov/region9/air/permit/index.html

USEPA. (2015g, June 28). Status of State SIP Infrastructure Requirements - Maine Infrastructure Requirements by Pollutant. Retrieved June 28, 2015, from http://www3.epa.gov/airquality/urbanair/sipstatus/reports/me_infrabypoll.html

USEPA. (2015h, October). The Green Book Nonattainment Areas for Criteria Pollutants. Retrieved from http://www3.epa.gov/airquality/greenbk/index.html

USEPA. (2015i). *Cleanups in my Community*. Retrieved September 8, 2015, from http://www2.epa.gov/cleanups/cleanups-my-community

USEPA. (2015j, July 28). Cleanups in My Community List Results. Retrieved July 28, 2015, from http://ofmpub.epa.gov/apex/cimc/f?p=100:35:12363325135949:::35:P35_State_code,P35_ADV_QUERY:ME,((SF_EI_HE_CODE='N'))

USEPA. (2015k, June). *U.S. Greenhouse Gas Emissions*. Retrieved September 22, 2015, from http://www3.epa.gov/climatechange/science/indicators/ghg/us-ghg-emissions.html

USEPA. (2015l, October 8). *Emissions & Generation Resource Integrated Database (eGRID) Summary Table 1*. Retrieved March 10, 2016, from http://www.epa.gov/energy/egrid-2012-summary-tables

USEPA. (2015m). *Terms & Acronyms Search Page*. Retrieved from https://iaspub.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do

USEPA. (2015n, January). *Chesapeake Bay Glossary*. Retrieved July 15, 2015, from http://ofmpub.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do?details=&glossaryName=Chesapeake%20Bay%20Glossary

USEPA. (2015o, Nov 19). *Wetlands Classification Types*. Retrieved Dec 3, 2015, from http://www2.epa.gov/wetlands/wetlands-classification-and-types#fens

USEPA. (2015p). *Terms & Acronyms Search Page*. Retrieved from https://iaspub.epa.gov/sor_internet/registry/termreg/searchandretrieve/termsandacronyms/search.do

USEPA. (2015q, July 17). Technology Transfer Network - Basic Information. Retrieved July 17, 2015, from http://cfpub.epa.gov/oarweb/mkb/basic_information.cfm

USEPA. (2015r, January 30). Designations. Retrieved April 20, 2015, from http://www3.epa.gov/airquality/greenbk/define.html

USEPA. (2015s, August 26). *Waste Site Cleanup & Reuse in New England - Callahan Mining Corp*. Retrieved from http://yosemite.epa.gov/r1/npl_pad.nsf/51dc4f173ceef51d85256adf004c7ec8/584c38df37ade1998525764f005a96d3!OpenDocument

USFS. (2005). *The Forests of Maine: 2003.* Retrieved from http://www.fs.fed.us/ne/newtown_square/publications/resource_bulletins/pdfs/2005/ne_rb164.pdf

USFS. (2009a, Sept 30). *Chapter 90 Communications Site Management.* Retrieved Nov 16, 2015, from Forest Service Handbook 2709.11 - Special Uses Handbook: http://www.fs.fed.us/specialuses/documents/Comm_Use_Policy_2709.11_90.doc

USFS. (2009b). *Soil-Disturbance Field Guide.* Retrieved from http://www.fs.fed.us/t-d/pubs/pdf/08191815.pdf

USFS. (2016, March 17). *White Mountain National Forest*. Retrieved from http://www.fs.usda.gov/detail/whitemountain/specialplaces/?cid=stelprdb5186041

USFWS. (2005). *Final Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon (Salmo salar)*. Retrieved from http://ecos.fws.gov/docs/recovery_plan/060407.pdf

USFWS. (2006, March 08). *U.S. Fish and Wildlife Service: Gulf of Maine Coastal Program, Habitat protection partnerships.* Retrieved September 8, 2015, from http://www.fws.gov/GOMCP/pdfs/GOMP%20protection%20(final2).pdf

USFWS. (2007). *Canada lynx habitat management guidelines for Maine*. Retrieved from http://www.fws.gov/mainefieldoffice/PDFs/Canada%20lynx%20habitat%20management%20guidelines%20for%20Maine%209.13.07.pdf

USFWS. (2009). *Soil-Disturbance Field Guide*. Retrieved September 2015, from http://www.fs.fed.us/t-d/pubs/pdf/08191815.pdf

USFWS. (2010, April 18). *USFWS National Digital Library: Wetland in Great Heath, Mt. Desert Isle*. Retrieved September 24, 2015, from http://digitalmedia.fws.gov/cdm/singleitem/collection/natdiglib/id/9792/rec/67

USFWS. (2011). *Roseate Tern*. Retrieved from http://www.fws.gov/northeast/pdf/Roseatetern0511.pdf

USFWS. (2012a). *Eastern Prairie Fringed Orchid (Platanthera leucophaea)*. Retrieved from http://www.fws.gov/mainefieldoffice/Eastern_prairie_fringed_orchid.html

USFWS. (2012b). *Furbish's Lousewort (Pedicularis furbishiae)*. Retrieved from http://www.fws.gov/mainefieldoffice/Furbish_lousewort.html

USFWS. (2013a). *Canada Lynx (Lynx candensis)*. Retrieved from http://www.fws.gov/mountain-prairie/species/mammals/lynx/CandaLynxFactSheet_091613.pdf

USFWS. (2013b). *Hawksbill Sea Turtle (Eretmochelys imbricata) 5-Year Summary and Evaluation*. Retrieved from http://ecos.fws.gov/docs/five_year_review/doc4168.pdf

USFWS. (2014a). *National Wetlands Inventory website*. Retrieved May 15, 2015, from http://www.fws.gov/wetlands/

USFWS. (2014b). *Canada lynx (Lynx canadensis) - Threatened*. Retrieved from http://www.fws.gov/mainefieldoffice/Canada_lynx.html

USFWS. (2015a, January 26). *Wetlands Mapper Legend Categories*. Retrieved April 20, 2015, from National Wetland Inventory: http://www.fws.gov/wetlands/Data/Mapper-Wetlands-Legend.htm

USFWS. (2015b, January 26). *Data Limitations, Exclusions and Precautions*. Retrieved May 11, 2015, from http://www.fws.gov/wetlands/Data/Limitations.html

USFWS. (2015c). *Listed species believed to or known to occur in Maine*. Retrieved from http://ecos.fws.gov/tess_public/reports/species-listed-by-state-report?state=ME&status=listed

USFWS. (2015d). *Critical Habitat Portal*. Retrieved from http://ecos.fws.gov/crithab/

USFWS. (2015e). *Northern Long-eared bat fact sheet*. Retrieved from http://www.fws.gov/midwest/endangered/mammals/nleb/nlebFactSheet.html

USFWS. (2015f). *Northern Long-Eared Bat Range*. Retrieved from http://www.fws.gov/midwest/endangered/mammals/nleb/documents/NLEBRangeCountyList043015.xls

USFWS. (2015g). *Piping Plover (Charadrius melodus)*. Retrieved from http://www.fws.gov/charleston/pdf/PIPL_page.pdf

USFWS. (2015h). *Red Knot*. Retrieved from http://www.fws.gov/northeast/njfieldoffice/endangered/redknot.html

USFWS. (2015i). *Piping Plover, Atlantic Coast Population*. Retrieved from http://www.fws.gov/northeast/pipingplover/overview.html

USFWS. (2015j). *US Counties within Maine in which the Roseate tern, northeast U.S. nesting population, is known or believed to occur*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/countiesByState?entityId=135&state=Maine

USFWS. (2015k). *Species Profile for Green Sea Turtle (Chelonia mydas)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00S

USFWS. (2015l). *Species Profile for Hawksbill Sea Turtle (Eretmochelys imbricata)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00E

USFWS. (2015m). *Species Profile for Leatherback Sea Turtle (Dermochelys coriacea)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=C00F

USFWS. (2015n). *Hawksbill Sea Turtle Fact Sheet*. Retrieved from http://www.fws.gov/northflorida/seaturtles/turtle%20factsheets/hawksbill-sea-turtle.htm

USFWS. (2015o). *Atlantic sturgeon (Acipenser oxyrinchus oxyrinchus)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile?spcode=E0A7

USFWS. (2015p). *Species Profile Shortnose Sturgeon (Acipenser brevirostrum)*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E00B

USFWS. (2015q). *US Counties within Maine in which the Small Whorled pogonia, is known to or is believed to occur:*. Retrieved from http://ecos.fws.gov/speciesProfile/profile/countiesByState?entityId=742&state=Maine

USFWS. (2015r, July 1). *National Wildlife Refuge System: Find your refuge, by state*. Retrieved July 1, 2015, from http://www.fws.gov/refuges/refugeLocatorMaps/Maine.html

USFWS. (2015s). *U.S. Fish and Wildlife Service: Refuge List by State, Maine*. Retrieved September 8, 2015, from http://www.fws.gov/refuges/profiles/ByState.cfm?state=ME

USFWS. (2016). *Small Whorled Pogonia Fact Sheet*. Retrieved from http://www.fws.gov/midwest/endangered/plants/smallwhorledpogoniafs.html

USGCRP. (2009). *Global Climate Change Impacts in the United States.* New York: Cambridge University Press.

USGCRP. (2014a). *National Climate Assessment: Northeast Impacts*. Retrieved from U.S. Global Change Research Program: http://nca2014.globalchange.gov/report/regions/northeast#intro-section-2

USGCRP. (2014b). *U.S. Global Change Research Program: Precipitation Change*. Retrieved from National Climate Assessment: http://nca2014.globalchange.gov/report/our-changing-climate/precipitation-change

USGCRP. (2014c). *National Climate Assessment: Coastal Zone Development and Ecosystems*. Retrieved from U.S. Global Change Research Program: http://nca2014.globalchange.gov/report/regions/coasts#narrative-page-16832

USGCRP. (2014d). *National Climate Assessment: Changes in Storms*. Retrieved July 9, 2015, from U.S. Global Change Research Program: http://nca2014.globalchange.gov/report/our-changing-climate/changes-storms

USGCRP. (2014e). *National Climate Assessment - Coastal Zone Development and Ecosystems.* Retrieved December 31, 2015, from http://nca2014.globalchange.gov/report/regions/coasts#intro-section-2

USGCRP. (2014f). *National Climate Assessment - Extreme Weather*. Retrieved October 6, 2015, from http://nca2014.globalchange.gov/report/our-changing-climate/extreme-weather#intro-section-2

USGCRP. (2014g). *National Climate Assessment - Northeast Region*. Retrieved 10 08, 2015, from http://nca2014.globalchange.gov/report/regions/northeast

USGS. (1995). *Groundwater Atlas of the United States*. Retrieved July 9, 2015, from http://pubs.usgs.gov/ha/ha730/ch_m/M-text.html

USGS. (1999a). *Water Quality Assessment of the New England Coastal Basins in Maine, Massachusetts, New Hampshire, and Rhode Island: Environmental Settings and Implications for Water Quality and Aquatic Biota.* Retrieved June 2015, from http://pubs.usgs.gov/wri/wri984249/pdf/wrir98-4249.pdf

USGS. (1999b). *How Ground Water Occurs*. Retrieved February 12, 2013, from U.S. Geological Survey General Interest Publication: http://publs.usgs.gov/gip/gw/how_a/html

USGS. (2000). *Land Subsidence in the United States (Fact Sheet 165-00)*. Retrieved September 2013, from http://water.usgs.gov/ogw/pubs/fs00165/SubsidenceFS.v7.PDF

USGS. (2001). *Clay and Shale.* Retrieved September 2015, from http://minerals.usgs.gov/minerals/pubs/commodity/clays/claymyb01.pdf

USGS. (2003a). *A Tapestry of Time and Terrain: The Union of Two Maps, Geology and Topography*. Retrieved September 2013

USGS. (2003b). *The Mineral Industry of Maine.* Retrieved September 2015, from http://minerals.usgs.gov/minerals/pubs/state/2003/mestmyb03.pdf

USGS. (2003c). *National Landslide Hazards Mitigation Strategy – A Framework for Loss Reduction*. Retrieved September 2013, from http://pubs.usgs.gov/circ/c1244/c1244.pdf

USGS. (2008). *An Overview of Coastal Land Loss: With Emphasis on Southeastern United States*, USGS Open File Report 03-337. Retrieved from Coastal & Marine Geology Program: http://pubs.usgs.gov/of/2003/of03-337/sealevel.html

USGS. (2010). *What is "Peak Acceleration" or "Peak Ground Acceleration" (PGA)?* Retrieved April 2015, from http://geohazards.usgs.gov/deaggint/2002/documentation/parm.php

USGS. (2012a). *Earthquake Glossary - Earthquake.* Retrieved July 2015, from http://earthquake.usgs.gov/learn/glossary/?term=earthquake

USGS. (2012b, December). *The USGS Land Cover Institute*. Retrieved August 2015, from http://landcover.usgs.gov/classes.php/

USGS. (2012c). *Maine Land Cover*. Retrieved September 9, 2015, from http://landcover.usgs.gov/maine.php

USGS. (2012d, October 12). *Gap Analysis Program, Protected Areas Database of the United States (PADUS) v. 1.3 Fee*. Retrieved October 12, 2015, from http://gapanalysis.usgs.gov/padus/

USGS. (2013a). *Glossary of Glacier Terminology*. Retrieved August 2015, from http://pubs.usgs.gov/of/2004/1216/text.html#tz

USGS. (2013b, Sept 11). *Natural Hazards*. Retrieved Nov 28, 2015, from http://www.usgs.gov/natural_hazards/

USGS. (2013c). *Land Subsidence from Ground-water Pumping*. Retrieved September 2013, from http://geochange.er.usgs.gov/sw/changes/anthropogenic/subside/

USGS. (2014a). *Plate Tectonics Mapping.* USGS.

USGS. (2014b, November). *Water Resources of the United States*. Retrieved July 2015, from http://www.usgs.gov/water/

USGS. (2014c). *Water Quality in Principal Aquifers of the United States, 1991-2010*. Retrieved July 9, 2015, from http://pubs.usgs.gov/circ/1360/pdf/circ1360reportoptimized.pdf

USGS. (2014d, October 15). *National Atlas of the United States*. Retrieved October 15, 2015, from http://nationalmap.gov/small_scale/printable/fedlands.html

USGS. (2014e). *Sedimentary Rocks.* Retrieved July 2015, from http://geomaps.wr.usgs.gov/parks/rxmin/rock2.html

USGS. (2014f). *Measuring the Size of an Earthquake.* Retrieved July 2015, from http://earthquake.usgs.gov/learn/topics/measure.php

USGS. (2014g). *Landslide Overview Map of the Conterminous United States.* Retrieved June 2015, from http://landslides.usgs.gov/hazards/nationalmap/

USGS. (2014h, Feb 24). *Explanations for the National Water Conditions*. Retrieved Nov 22, 2015, from http://water.usgs.gov/nwc/explain_data.html

USGS. (2015a). *Water Science Glossary of Terms.* Retrieved June 2015, from http://water.usgs.gov/edu/dictionary.html#B

USGS. (2015b). *Paleontology.* Retrieved July 2015, from http://www.usgs.gov/science/science.php?term=861

USGS. (2015c). *Structural Geology.* Retrieved July 2015, from http://www.usgs.gov/science/science.php?term=1117

USGS. (2015d). *Geologic Glossary.* Retrieved October 2015, from http://geomaps.wr.usgs.gov/parks/misc/glossarya.html

USGS. (2015e). *Geologic Glossary.* Retrieved July 2015, from http://geomaps.wr.usgs.gov/parks/misc/glossarymn.html

USGS. (2015f). *Devonian Trout Valley Formation*. Retrieved June 2015, from http://mrdata.usgs.gov/geology/state/sgmc-unit.php?unit=MEDtv%3B0

USGS. (2015g). *2010-2011 Minerals Yearbook: Maine.* Retrieved June 2015, from http://minerals.usgs.gov/minerals/pubs/state/2010_11/myb2-2010_11-me.pdf

USGS. (2015h). *About U.S. Volcanoes.* Retrieved August 2015, from http://volcanoes.usgs.gov/about/volcanoes/

USGS. (2015i, June 3). *Dimension Stone Statistics and Information*. Retrieved November 30, 2015, from http://minerals.usgs.gov/minerals/pubs/commodity/stone_dimension/

USGS. (2016a). *Mineral Commodity Summaries.* Retrieved from http://minerals.usgs.gov/minerals/pubs/mcs/

USGS. (2016b, March). *Aquifer Basics*. Retrieved from https://water.usgs.gov/ogw/aquiferbasics/uncon.html

UVA Weldon Cooper Center. (2015). *University of Virginia Weldon Cooper Center for Public Service, National Population Projections, 2020-2040.* Retrieved March 2015, from http://www.coopercenter.org/demographics/national-population-projections

Weeks, K. D. (1995). The Secretary of the Interior’s Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes. Washington, DC. Retrieved October 13, 2015, from http://www.nps.gov/tps/standards/four-treatments/treatment-guidelines.pdf

Will, R. (1996). An Example of Late Middle Ceramic (Woodland) Period Biface Production Technology from Moosehead Lake, Maine. *http://www.jstor.org/stable/40914455*(24), 227-238. Retrieved September 2015, from http://www.jstor.org/stable/40914412

Will, R. (2002). Understanding Archaic Period Ground Stone Tool Technology through Debitage Analysis from the Clark 1 Site, Norridgewock, Maine. *Archaeology of Eastern North America, 30*. Retrieved September 2015, from http://www.jstor.org/stable/40914455

Willem Vereecken, W. V. (2011, July). Power Consumption in Telecommunications Networks: Overview and Reduction Strategies. *IEEE Communications Magazine*, pp. 62-69. Retrieved September 22, 2015, from http://www.researchgate.net/publication/228774201

World Wildlife Fund. (2015). *What is an Ecoregion?* Retrieved July 1, 2015, from http://wwf.panda.org/about_our_earth/ecoregions/about/what_is_an_ecoregion/

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