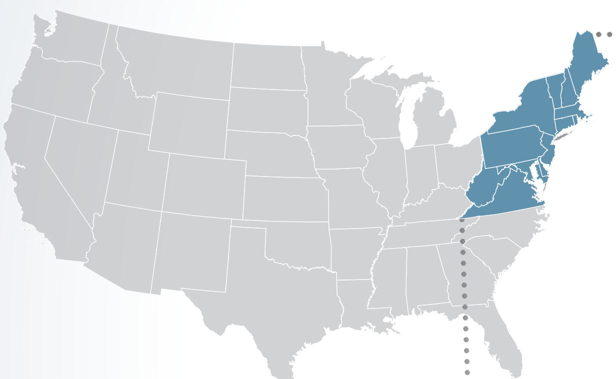
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 12 - CHAPTER 14



Connecticut
Delaware
District of Columbia
Maine
Maryland
Massachusetts
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New Jersey
New York
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Rhode Island
Vermont
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West Virginia

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First Responder Network Authority

FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Eastern United States

VOLUME 12 - CHAPTER 14

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

April 2016

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Contents

List of Figures

List of Tables

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14. VERMONT

First claimed for France by the explorer Samuel de Champlain, Vermont eventually became a British territory after the English won the French and Indian War. Vermont entered the Union in 1791, becoming the first state to do so after the end of Revolutionary War (State of Vermont, 2015a). Located in the northeastern United States, Vermont is bordered by Canada to the north, New Hampshire to the east, Massachusetts to the south, and New York to the west. This chapter provides details about the existing environment of Vermont as it relates to the Proposed Action. General facts about Vermont are provided below.

- **State Nickname**: The Green Mountain State
- **Land Area:** 9,217 square miles; **U.S. Rank**: 45 (U.S. Census Bureau, 2010) (U.S. Census Bureau, 2015aa)
- **Capital:** Montpelier
- **Counties:** 14 (U.S. Census Bureau, 2015a)
- **Estimated Population:** 626,562 people; **U.S. Rank:** 49 (U.S. Census Bureau, 2015b)
- **Most Populated Cites:** Burlington, South Burlington, and Rutland (U.S. Census Bureau, 2015a)
- **Main Rivers:** Connecticut River, Otter Creek, Winooski River, White River, Black River, Lamoille River, and Missisquoi River
- **Bordering Waterbodies:** Lake Champlain and Connecticut River
- **Mountain Ranges:** Green Mountains and Taconic Mountains
- **Highest Point:** Mt. Mansfield (4,393 ft) (U.S. Geological Survey, 2015a)

14.1. AFFECTED ENVIRONMENT

14.1.1. Infrastructure

14.1.1.1. Introduction

This section provides information on key Vermont 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 14.1.1.3 provides an overview of Vermont's traffic and transportation infrastructure, including road and rail networks and waterway facilities. Vermont's public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in the Act, including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by the Act. Public safety services in Vermont are presented in more detail in Section 14.1.1.4. Section 14.1.1.5 describes the Vermont's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of Vermont's utilities, such as power, water, and sewer, is presented in Section 14.1.1.6.

14.1.1.2. Specific Regulatory Considerations

Multiple Vermont laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 14.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state's applicable statutes and administrative rules referenced in column one. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

Table 14.1.1-1: Relevant Vermont Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Title 3 Appendix: Executive Orders; Title 30: Public Service; Code of Vermont Rules: Agency 30. Public Service Board	Public Service Department; Public Service Board (PSB)	Develops state energy plan; assesses energy resources available for electrical generation; provides plans for meeting emerging trends; identifies best practices for the siting and approval of electric generation projects; oversees the implementation of a state agency energy plan that identifies opportunities for resource conservation.

[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
Title 3 Appendix: Executive Orders; Title 20: Internal Security and Public Safety; Code of Vermont Rules: Agency 28. Department of Public Safety	Department of Public Safety (DPS); Division of Emergency Management and Homeland Security (DEMHS)	Manages the state's homeland security preparedness; ensures adequately trained and equipped emergency management personnel; prevents, plans, mitigates, and supports response and recovery efforts from all hazards including natural disasters, health or disease-related emergencies, accidents, civil insurrection, use of weapons of mass destruction, terrorist or criminal incidents, radiological incidents or other significant events.
Title 30: Public Service; Code of Vermont Rules: Agency 30. Public Service Board	Public Service Department; PSB	Regulates the construction and maintenance of electric, gas, telephone, telegraph, and cable television systems and facilities; regulates public utilities companies' rates and terms and quality of service; oversees the organization and operation of municipal plants and electric cooperatives and persons, firms, companies, corporations, and municipalities engaged in the business of manufacturing, distributing, selling, or transmitting gas; governs companies engaged in the collection, sale, and distribution of water for domestic, industrial, business, or fire protection purposes, in the construction and maintenance of dams and storage reservoirs, or in the collection or disposal of wastewater or domestic sewage; regulates telecommunications service via wires, cables, television cables, microwaves, radio waves, and light waves (except value added nonvoice services) and the construction or installation of telecommunications facilities including towers.
Title 3, Executive	AoA, Division for Connectivity; Department of Innovation and Information (DII); VTrans; Commissioner of Public Service	Promotes access to affordable broadband service and the universal availability of mobile telecommunication services including voice and high-speed data; prioritizes the use of existing buildings and structures, historic or otherwise, as sites for visually neutral placement of mobile telecommunications and wireless broadband antenna facilities; waives/reduces state fees for access to state-owned rights-of-way in exchange for comparable value.
Title 3: Executive; Title 3 Appendix: Executive Orders; Title 5: Aeronautics and Surface Transportation; Title 19: Highways; Title 23: Motor Vehicles; Code of Vermont Rules: Agency 14. Agency of Transportation	VTrans including Department of Aeronautics; Department of Highways; Department of Motor Vehicles (DMV); and Department of Bus, Rail, Waterways, and Motor Carrier Services; Public Service Department; Vermont Aviation Advisory Council; Vermont Rail Advisory Council; Airport Zoning Commission; Surface Transportation Board; Vermont Aeronautics Board	Develops state transportation policy; creates the state transportation plan; maintains intercity bus and freight and commuter rail services including intermodal connections; oversees the planning, construction, repair, and maintenance of transportation related facilities; repairs, rehabilitates, restores, and maintains historic bridges; ensures adequate access to the national air transportation network for Vermont shippers and travelers; oversees the design, establishment, construction, operation, improvement, and maintenance of airports, restricted landing areas, and other air navigation facilities; manages and develops airports owned by the state; licenses operators; registers motor vehicles and dealers; licenses drivers; oversees National Highway Safety Act

Sources: (Bluehouse Group, 2015) (LexisNexis, 2015)

14.1.1.3. Transportation

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

The Vermont Agency of Transportation (VTrans) has jurisdiction over freeways and major roads, airports, railroads, mass transit, and harbors in the state; local counties have jurisdiction for local streets and roads. The responsibilities of the VTrans include "planning, development, implementation and maintenance of a variety of transportation and infrastructure including but not limited to roads, bridges, state-owned railroads, airports, park and ride facilities, bicycle facilities, pedestrian paths, public transportation facilities and services, and Department of Motor Vehicles operations and motor carrier enforcement" (VTrans, 2015a).

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

- 14,266 miles of roadway and 3,995 bridges (VTrans, 2015a);
- 578 miles of active rail lines that includes passenger rail and freight (VTrans, 2015b);
- 81 aviation facilities, including airstrips and heliports (Federal Aviation Administration, 2015a); and
- No major ports (U.S. Census Bureau, 2015c).

Road Networks

As identified in Figure 14.1.1-1 the major urban center of Vermont is Burlington-South Burlington in the northwestern corner of the state (U.S. Department of Commerce, 2013a). Vermont has three major interstates connecting its major metropolitan areas to one another, as well as to other states. Travel to local towns is conducted mainly via state and county routes. Table 14.1.1-2 lists the interstates and their start/end points in Vermont. 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 (DOT, 2015a).

Table 14.1.1-2: Vermont Interstates

Interstate	Southern or western terminus in VT	Northern or eastern terminus in VT
I-89	New Hampshire state border line at White River Junction, VT	U.S.-Canadian international border at Swanton, VT
I-91	Massachusetts state border at Guilford, VT	U.S.-Canadian international border at Derby, VT
I-93	I-91 at St. Johnsbury, VT	New Hampshire state border at Waterford, VT

In addition to the Interstate System, Vermont 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 14.1.1-1 illustrates the major transportation networks, including roadways, in Vermont. Section 14.1.8, Visual Resources, describes the National and Scenic Byways found in Vermont 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 Federal Highway Administration. Vermont has one National Scenic Byway: the Connecticut River Byway. This scenic byway is 498.7 miles long and runs along the length of the Connecticut River (DOT, 2015b). The Connecticut River forms the boundary between Vermont and New Hampshire; therefore, the scenic byway runs along the entire eastern edge of Vermont.

State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by VTrans. Vermont has nine State Scenic Byways that crisscross the entire state (VTrans, 2015c):

- Crossroads of Vermont,
- Green Mountain,
- Lake Champlain,
- Mad River,
- Molly Stark,
- Northeast Kingdom Byway,
- Scenic Rte. 100 Byway,
- Shires of Vermont, and
- Stone Valley.

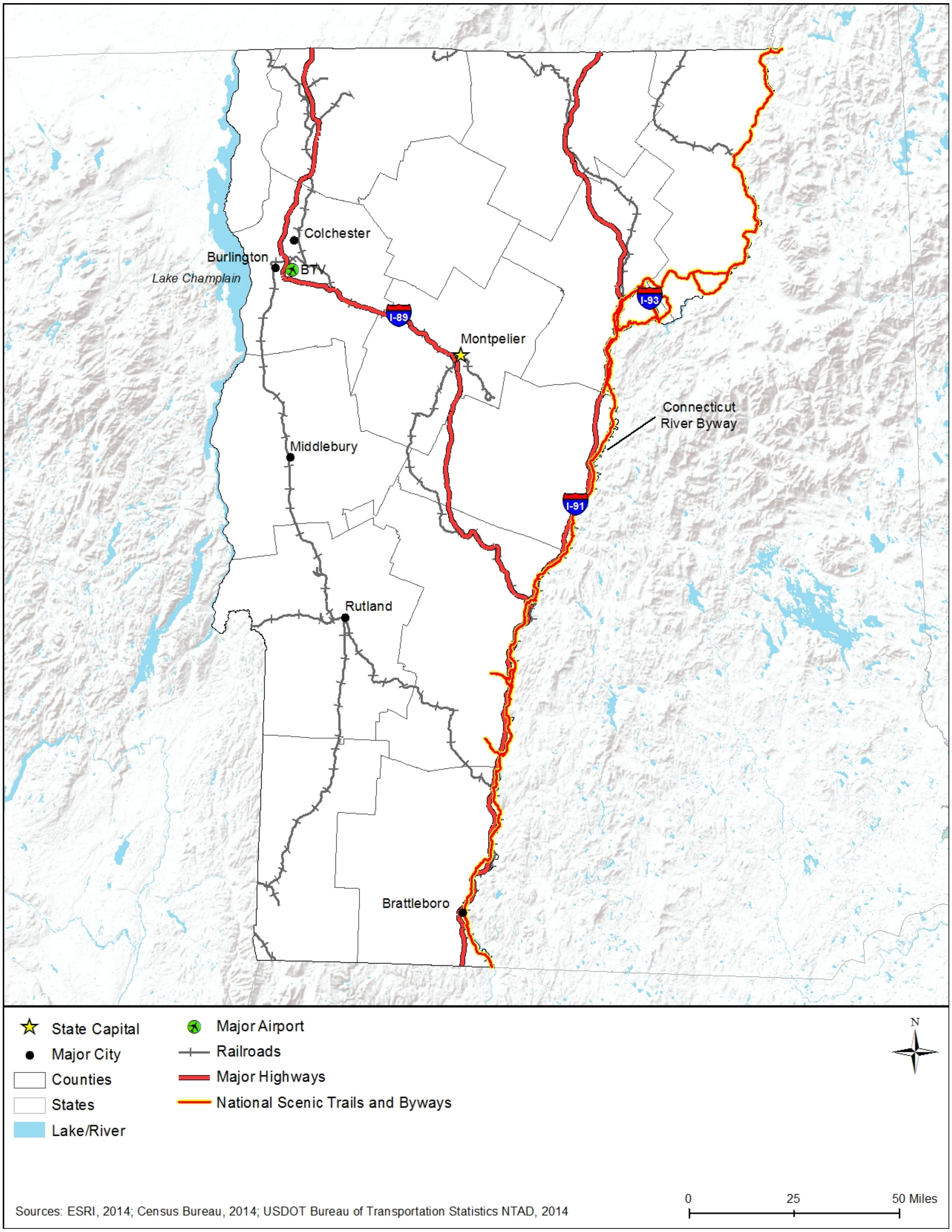


Figure 14.1.1-1: Vermont Transportation Networks

Airports

Air service to the state is provided by a number of nearby major international airports, including Logan International Airport in Massachusetts. Vermont's largest airport is the Burlington International Airport (BTV), which is owned by the municipality and operated by the Burlington Airport Commission. In 2014, the Burlington Airport had 611,805 enplanements (Burlington International Airport, 2015a) and 607,009 deplanements (Burlington International Airport, 2015b), for a total of 1,218,814 passengers served[2]. Figure 14.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 14.1.7.8, Airspace, provides greater detail on airports and airspace in Vermont.

Rail Networks

Vermont is connected by a large rail network of passenger rail (Amtrak) and freight rail. All of the state's 578 miles of railroad are utilized by freight rail and two of those routes are also used by Amtrak (VTrans, 2015d). The state owns 305 miles of the active rail network (VTrans, 2015d); the remaining tracks are owned by freight rail companies. Figure 14.1.1-1 illustrates the major transportation networks, including rail lines, in Vermont.

Amtrak runs two lines through Vermont. The Vermonter line provides daily service between Washington, DC and St. Albans in northern Vermont; the line runs the length of Vermont, stopping at nine stations in the state. In fiscal year 2014, the Vermonter served 89,640 riders and the Ethan Allen Express served 52,755 riders (VTrans, 2015e). Table 14.1.1-3 provides a complete list of Amtrak lines that run through Vermont.

Table 14.1.1-3: Amtrak Train Routes Serving Vermont

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in Vermont
Ethan Allen Express	Rutland, VT	New York, NY	5 hours 30 minutes	Rutland, Castleton
Vermonter	St. Albans, VT	Washington, DC	13 hours 45 minutes	St. Albans, Essex Junction, Waterbury, Montpelier, Randolph, White River Junction, Windsor, Bellows Falls, Brattleboro

Source: (Amtrak, 2015)

In 2011, approximately 6.6 million tons of freight were carried by rail in Vermont (VTrans, 2015f). At 69 percent, the majority of freight rail traveled through Vermont to other states, 26 percent of the freight traveled to or from Vermont, and only 5 percent traveled within the state (VTrans, 2015f).

Harbors

With the exception of its western border on Lake Champlain, Vermont is a landlocked state. The River Richelieu connects the northern end of the lake to the St. Lawrence Seaway in Quebec.

[2] Enplanements means boarding a plane to leave the airport; deplanement means leaving an airplane after it arrives at its destination.

Lake Champlain Ferries offers ferry transport from three points in the area of Lake Champlain. Ferries run from Grand Isle in the middle of Lake Champlain to Plattsburgh New York. They also run from Burlington, Vermont to Port Kent, New York, and from Charlotte, Vermont to Essex, New York. Additionally, the Ticonderoga Ferry Company runs ferries between Shoreham, Vermont to Ticonderoga, New York. Burlington, Charlotte, and Shoreham all border Lake Champlain, with Shoreham being the most southern town of the group (VTrans, 2015g). Though a number of small harbors and marinas dot the coast of Lake Champlain, there are no large harbors of note in the state of Vermont.

14.1.1.4. Public Safety Services

Vermont 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 14.1.1-4 presents Vermont's key demographics including population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 14.1.9, Socioeconomics.

Table 14.1.1-4: Key Vermont Indicators

Vermont Indicators	
Estimated Population (2014)	626,562
Land Area (square miles) (2010)	9,217
Population Density (persons per sq. mile) (2010)	67.9
Municipal Governments (2013)	45

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

Table 14.1.1-5 presents Vermont's public safety infrastructure, including fire and police stations. Table 14.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 14.1.1-5: Public Safety Infrastructure in Vermont by Type

Infrastructure Type	Number
Fire and Rescue Stations	450
Law Enforcement Agencies	64
Fire Departments	247

Sources: (FEMA, 2015a)

Table 14.1.1-6: First Responder Personnel in Vermont by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers	310
Fire and Rescue Personnel	3,787
Law Enforcement Personnel	2,543
Emergency Medical Technicians and Paramedics	530

Source: (FEMA, 2015a)

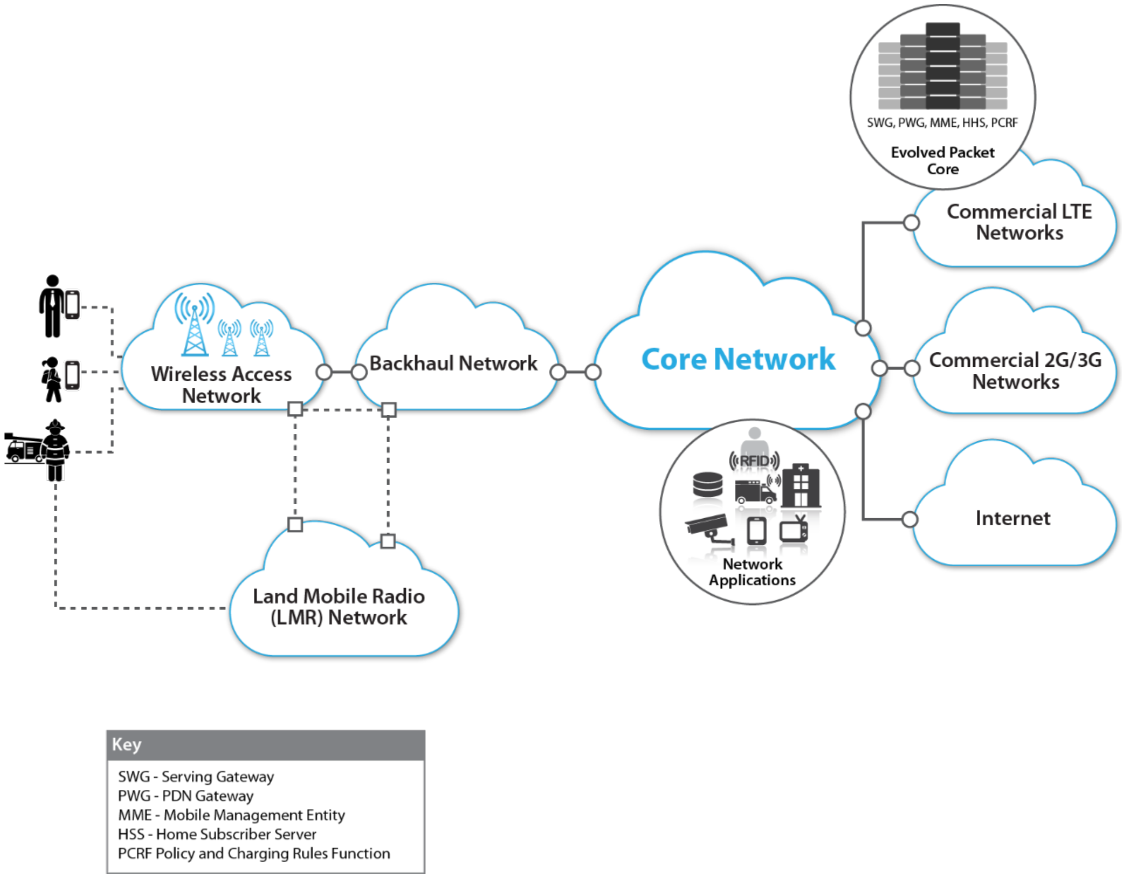
14.1.1.5. Telecommunications Resources

Telecommunication resources in Vermont can be divided into two primary categories: specific public safety communications infrastructure and commercial infrastructure (Federal Communications Commission, 2015a) (Bureau of Labor Statistics, 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 Vermont 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 (Bureau of Labor Statistics, 2016). Figure 14.1.1-2 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 (Federal Communications Commission, 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 long-term evolution (LTE) (see Section 2.1.1), has the potential to provide users with better coverage, while offering additional capacity and enabling the use of new applications that would likely make their work safer and more efficient. Designing such a network presents several challenges due to the uniqueness of the deployment, the requirements, and the nationwide scale (DOC, 2015a). Historically, there have been many challenges and impediments to timely and effective sharing of information, including jurisdictional challenges, funding challenges, the pace of technology evolution, and communication interoperability. Communication interoperability has been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (National Task Force on Interoperability, 2005). This has caused a fragmented approach to communications implementation across the U.S. and at the state level, including in Vermont.



Prepared by: Booz Allen Hamilton

Figure 14.1.1-2: Wireless Network Configuration

There are five key reasons why Public Safety agencies often cannot connect through existing communications (National Task Force on Interoperability, 2005):

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

To help enable the public safety community to incorporate disparate Land Mobile Radio (LMR) networks into a nationwide public safety LTE broadband network, the U.S. Department of Commerce Public Safety Communications Research Program (PSCR) – Boulder Laboratories, in 2015, 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 (PSCR, 2015)

Public safety network communications in Vermont reflect a combination of older Very High Frequency (VHF)[3] and Ultra High Frequency (UHF)[4] analog[5] radios operating across multiple frequency bands. No statewide Project 25 (P-25) digital[6] wireless radios or infrastructure is currently deployed in Vermont (P25.org, 2015).

The Vermont Communications Board in its Standard Operating Procedure (SOP) Interoperability Report summarized Vermont's public safety LMR frequency usage and interoperability environment as follows: "There are over 18,000 public safety radio devices in the state of Vermont. Currently 87 percent of public safety agencies in the state of Vermont use VHF for public safety frequency needs. Fire services operate primarily in the VHF band, while the police services operate primarily in the UHF band. Interoperability between different agencies takes place in Vermont today due largely to the fact that agencies within the same service share the same frequency band. Adjoining towns have each other's frequencies programmed into their radios to facilitate communication. The major roadblock occurs where adequate radio coverage does not exist, or when public safety agencies travel outside their routine jurisdictional footprint." (Vermont Communications Board, 2015).

In 2010, the Vermont Telecommunications Authority (VTA) was created by the Vermont Legislature to improve telecommunications infrastructure in the state. VTA continues to function as a consortia of local, county, and state communication representatives, and public safety subject matter experts, to address future public safety wireless communication infrastructure and end user needs. VTA along with its grant recipient partner, Sovernet, was awarded a National Telecommunications and Information Authority (NTIA) Broadband Technology Opportunity Program (BTOP) infrastructure grant for Vermont FiberLink. The FiberLink project deployed fiber optic infrastructure across Southern, Central, and Northeastern Vermont and increased fiber speeds to 1 Gigabit per second (Gbps) for Community Anchor Institutions (CAIs). Figure 14.1.1-3 depicts the fiber footprint for the FiberLink network serving public safety CAIs and a wide range of other CAIs including hospitals, libraries, and colleges. The FiberLink project connects 29 public safety institutions via its high-speed fiber.

In Vermont, the lead organization over public safety is the Department of Public Safety (DPS), which has responsibility for key public safety services including the 9-1-1 emergency response, and Public Safety Answering Points (PSAPs). The four main units within the Vermont DPS are: Emergency Management and Homeland Security; Vermont State Police; Division of Fire Safety; and Division of Criminal Justice (Vermont Department of Public Safety, 2015). In addition, to address public safety narrow-band requirements and interoperability planning, Vermont instituted the Vermont Communications Board (VCOMM), which is defined as: "…a diverse group of local, state, and federal representatives and private community professionals working

[3] VHF band covers frequencies ranging from 30 MHz to 300 MHz (U.S. Department of Commerce, 2005)

[4] UHF band covers frequencies ranging from 300 MHz to 3000 MHz (U.S. Department of Commerce, 2005)

[5] 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.

[6] Digital networks are those that allow for simultaneous digital transmission of voice, data, video, and other network services over the traditional public-switched telephone network, or over new 3G, 4G, or LTE wireless networks.

together to develop a shared interoperable radio communications system for all first responders within Vermont" (Department of Public Safety Vermont Communications, 2015).

Statewide Public Safety Networks

Vermont's state and local public safety users operate on a combination of VHF and UHF LMR analog networks (Radio Reference.com, 2015a). Common or Shared UHF frequencies (460.025-460.50 MHz) provide Law Enforcement with statewide mutual aid as well as statewide car-to-care services and statewide intercounty communications for sheriffs (Radio Reference.com, 2015b). Vermont State Police operate tactical and interoperability communications on analog UHF radios on 460.025-460.500 MHz with Statewide Emergency Medical Services (EMS) in Vermont on VHF (155.280 MHz) (Radio Reference.com, 2015c).

Vermont public safety agencies and additional state agencies and departments are served by a 25-tower site network as presented in Figure 14.1.1-3. The Vermont State land mobile network is interconnected to fiber and microwave, as Figure 14.1.1-4 depicts, to support tower-to-tower connectivity and upstream traffic backhaul.[7]

Local/Dispatch Public Safety Networks

As discussed above, local and tactical communications including dispatch are handled in Vermont on a combination of analog VHF and UHF frequencies. Mutual aid and incident response communications in Vermont are provided over VHF and UHF frequencies and programmable radios.

PSAPs

According to the Federal Communications Commission's (FCC) Master PSAP registry, there are seven PSAPs supporting Vermont (Federal Communications Commission, 2015b). The seven PSAPs are located in: White River Junction, Hyde Park, St. Albans, Derby, Chester, Rutland, and Willston. According to the Vermont Department of Public Safety Fiscal Year 2016 Budget Presentation: "The State PSAPs answer approximately 75 percent of the total 9-1-1 calls received annually, with the local PSAPs answering the remaining 25 percent." (Flynn, 2015).

Commercial Telecommunications Infrastructure

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

[7] According to the VT Department of Public Safety "the yellow and pink lines in the image…show the connections to/from the radio sites and dispatch facilities." (Flynn, 2015)

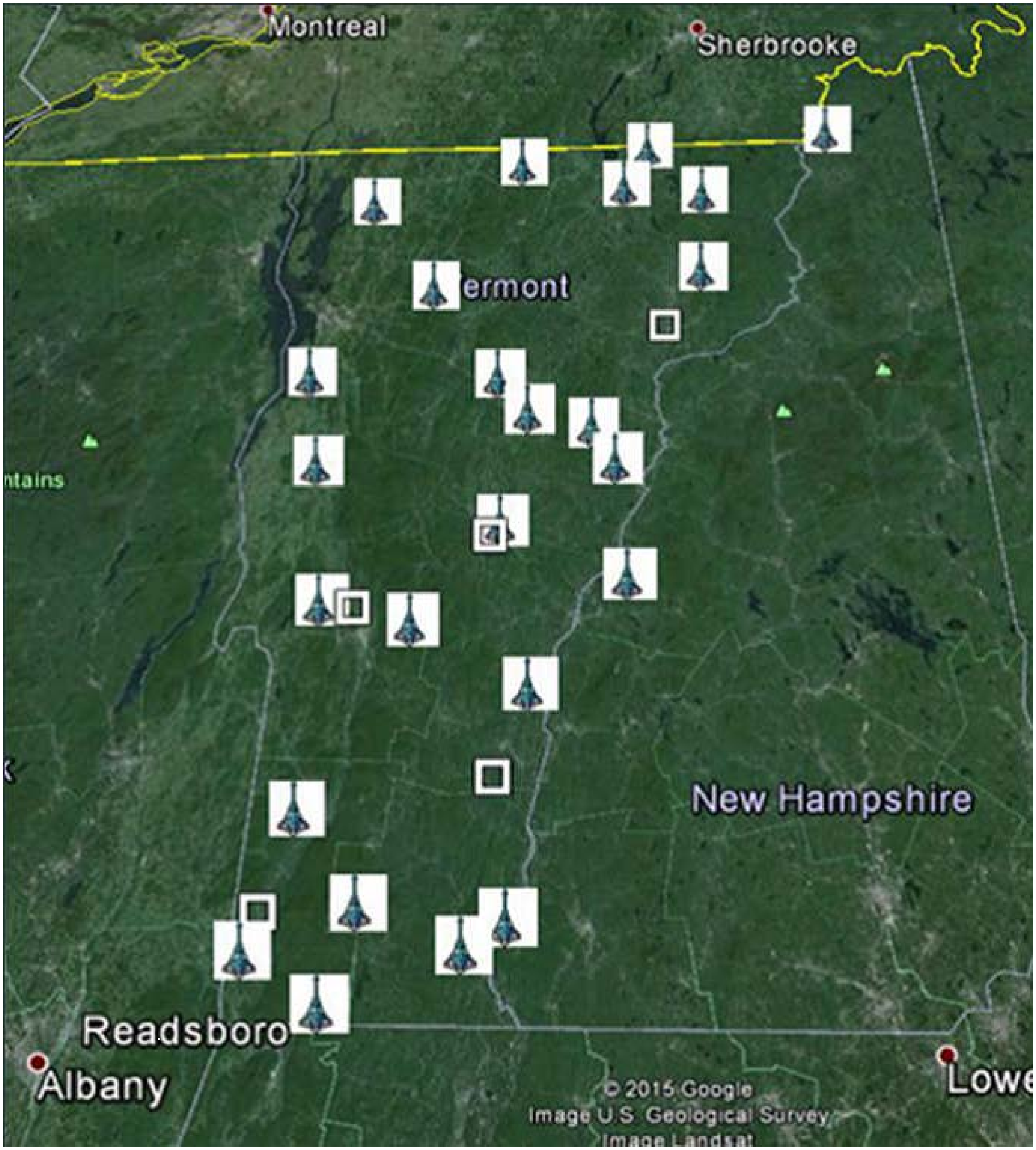


Figure 14.1.1-3: Vermont Public Safety Statewide Towers

Source: (Flynn, 2015)

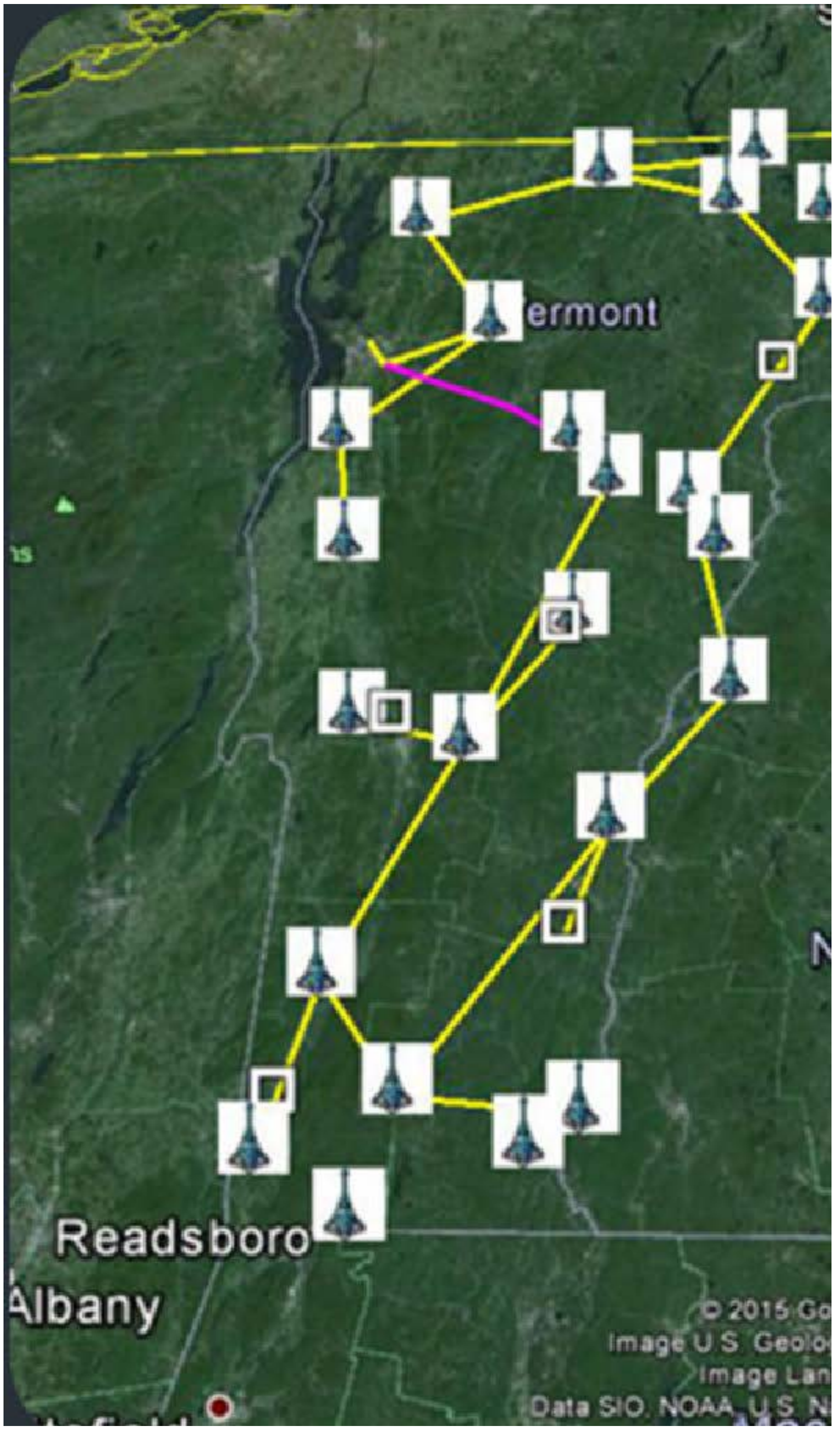


Figure 14.1.1-4: Vermont State Agency Microwave and Fiber Tower Connections

Source: (Flynn, 2015)

Carriers, Coverage, and Subscribers

Vermont's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems. Table 14.1.1-7 presents the number of providers of switched access[8] lines, Internet access[9], and mobile wireless services including coverage.

Table 14.1.1-7: Telecommunications Access Providers and Coverage in Vermont as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage
Switched access lines	82	98% of households
Internet access	31	71% of households
Mobile wireless	13	83% of population

Sources: (Federal Communications Commission, 2014a) (Federal Communications Commission, 2014b) (U.S. Department of Commerce, 2014)

Table 14.1.1-8 shows the wireless providers in Vermont along with their geographic coverage. The following four maps, Figure 14.1.1-5 thorough Figure 14.1.1-8 show: the combined coverage for the top two providers AT&T and Verizon Wireless; Sprint Nextel's and U.S. Cellular's coverage; GlobalNet's, Kingdom Connection's, and Great Auk Wireless's coverage; and the coverage of all other providers with less than 5 percent coverage area, respectively.

Table 14.1.1-8: Wireless Telecommunications Coverage by Providers in Vermont

Wireless Telecommunications Providers	Coverage
AT&T Mobility	93.30%
Verizon Wireless	67.75%
Sprint Nextel	16.13%
U.S. Cellular	13.86%
Great Auk Wireless, LLC	9.49%
Kingdom Connection	7.77%
GlobalNet	5.69%
Other[a]	5.46%

Source: (U.S. Department of Commerce, 2014)

[a] Other: Provider with less than 5% coverage area. Providers include: Cloud Alliance, LLC; WaveComm; North Branch Networks; WirelessVT Solutions; North Country Communications; Southern Vermont Broadband Cooperative

[8] "A service connection between an end user and the local telephone company's switch; the basis of plain old telephone services (POTS)" (Federal Communications Commission, 2014a)

[9] Internet access includes DSL, cable modem, fiber, satellite, and fixed wireless providers

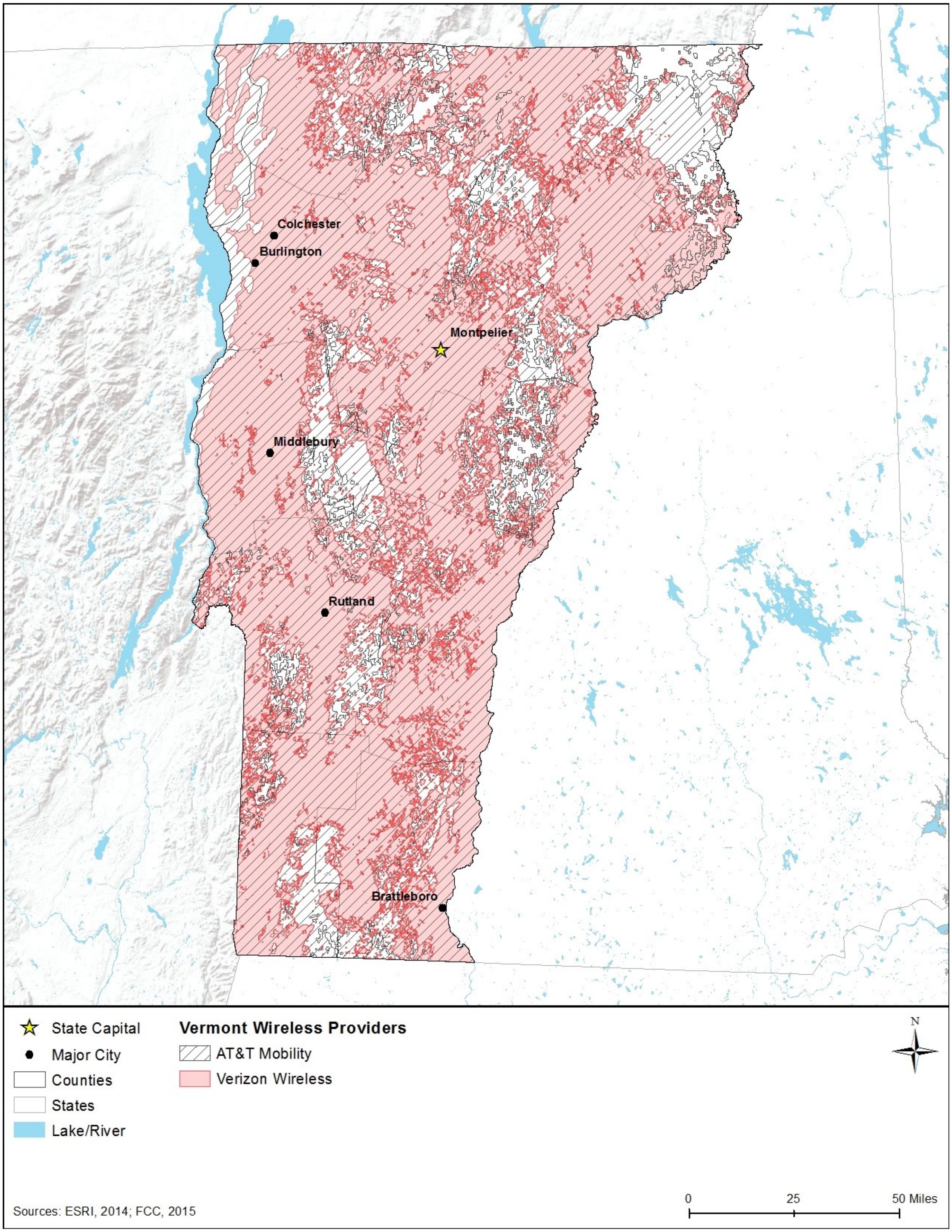


Figure 14.1.1-5: AT&T and Verizon Wireless Availability in Vermont

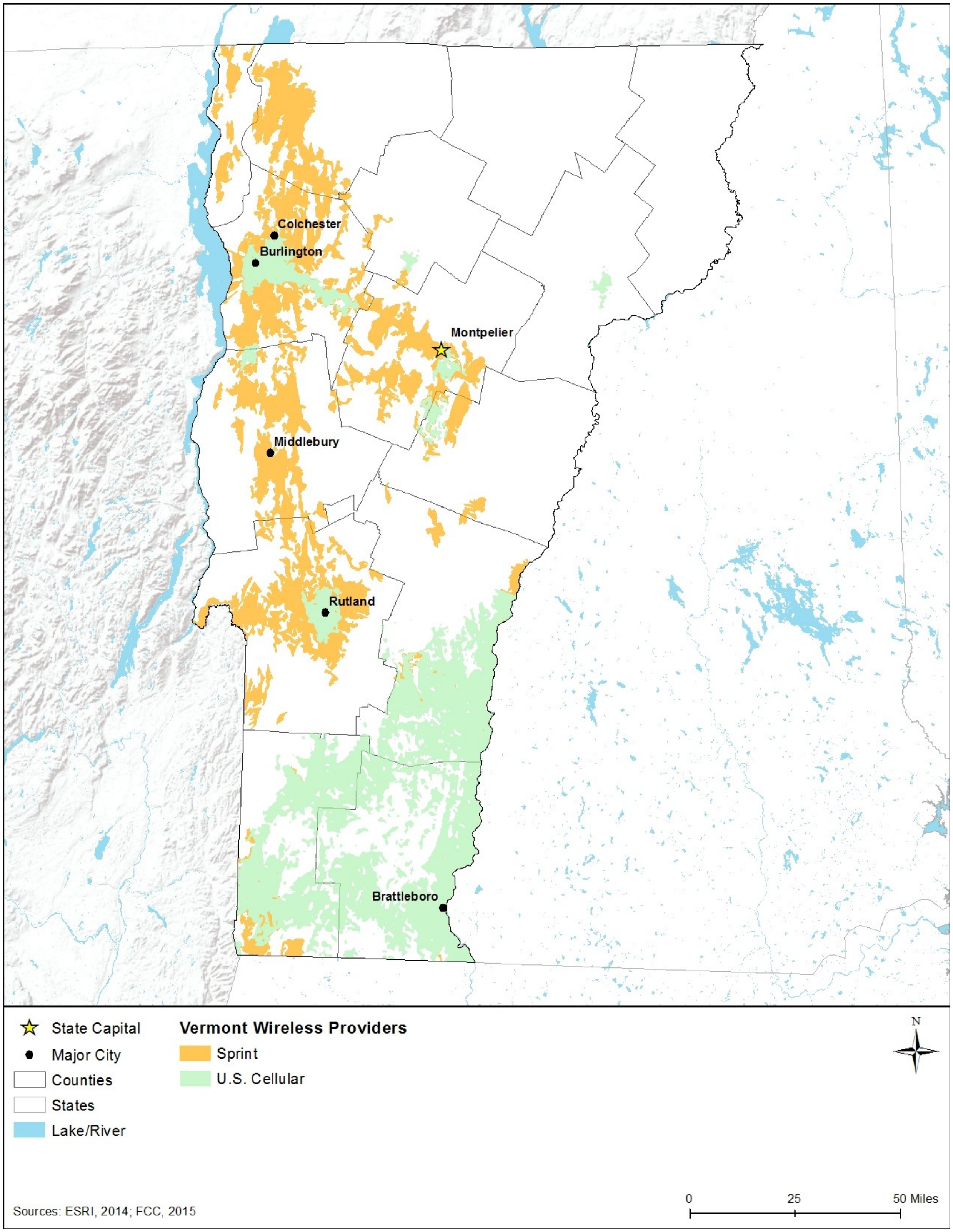


Figure 14.1.1-6: Sprint Nextel and U.S. Cellular Wireless Availability in Vermont

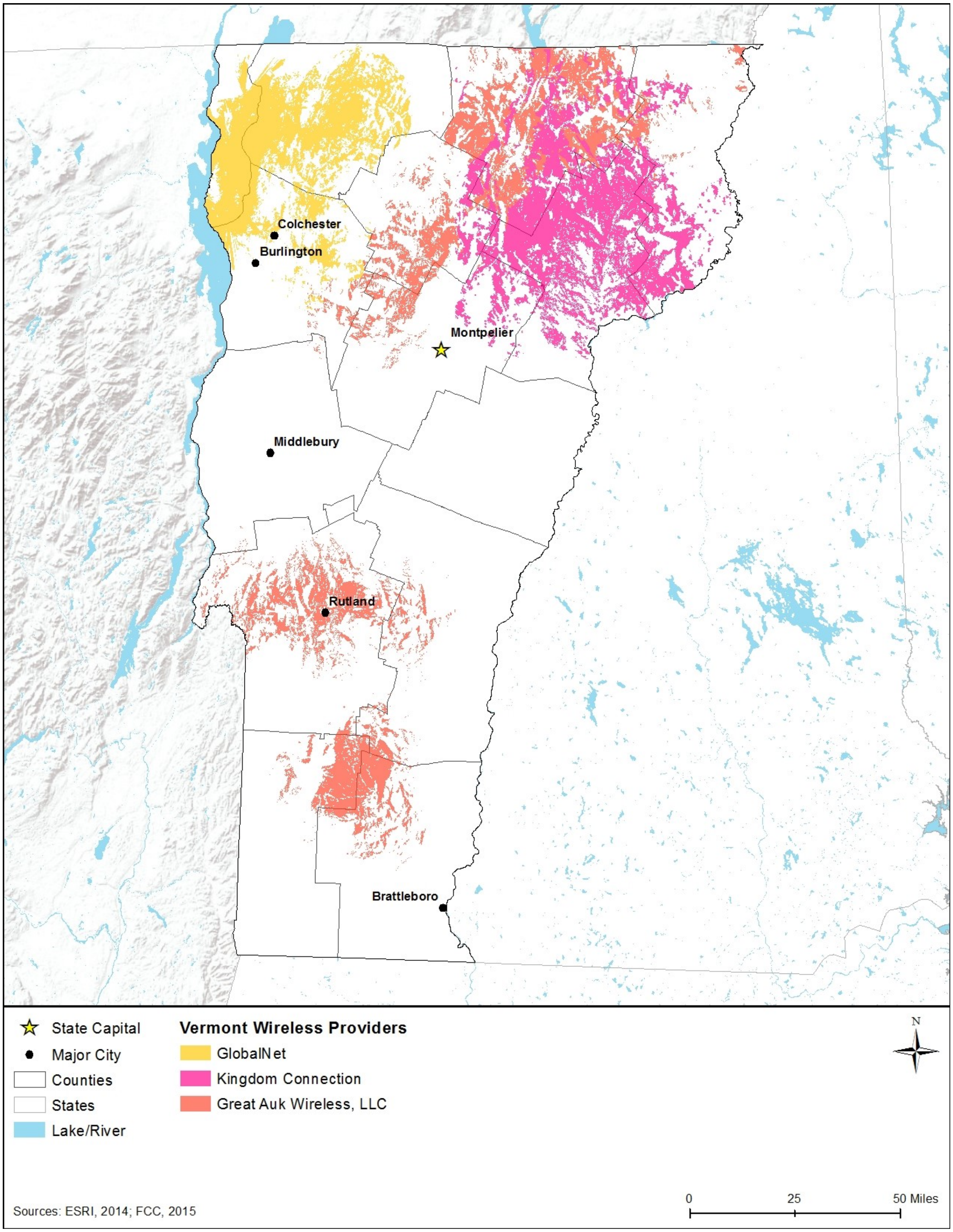


Figure 14.1.1-7: GlobalNet, Kingdom Connections, and Great Auk Wireless Availability in Vermont

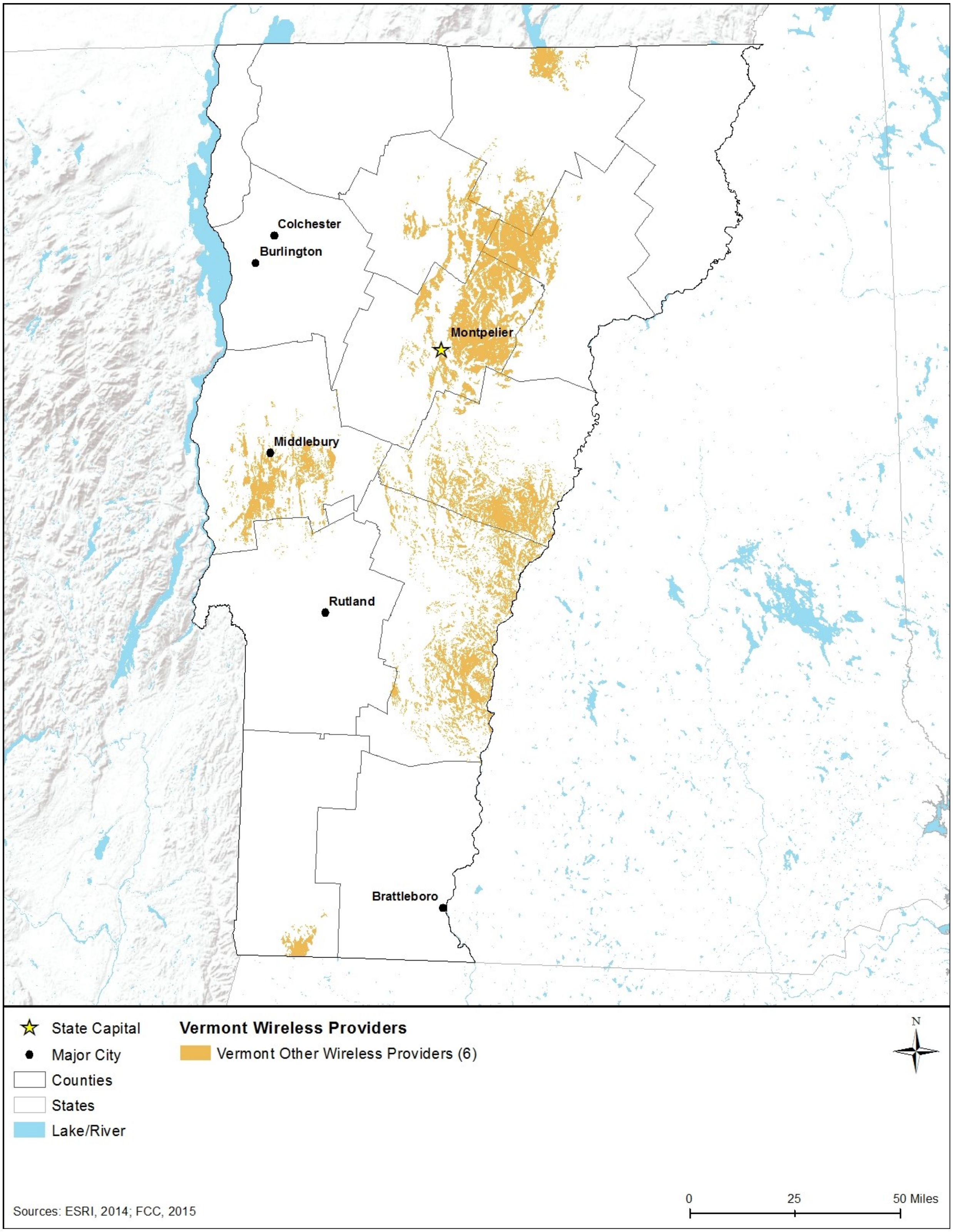


Figure 14.1.1-8: Wireless Availability in Vermont for Other Coverage Providers

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 14.1.1-9 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 14.1.1-9: Types of Towers

Telecommunications tower infrastructure is sporadic throughout Vermont, although tower infrastructure is concentrated in the higher and more densely populated areas. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC (Federal Communications Commission, 2016b) [10] Table 14.1.1-9 shows the number of towers (including broadcast towers) registered with the FCC in the state of Vermont. Table 14.1.1-9 shows the location of those 101 structures, as of June 2015.

Table 14.1.1-9: Number of Commercial Towers in Vermont by Type

Constructed[a] Towers[b]		**Constructed Monopole Towers**	
100ft and over	2	100ft and over	0
75ft – 100ft	7	75ft – 100ft	0
50ft – 75ft	14	50ft – 75ft	0
25ft – 50ft	32	25ft – 50ft	7
25ft and below	23	25ft and below	1
Subtotal	**78**	**Subtotal**	**8**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	4	100ft and over	0
75ft – 100ft	2	75ft – 100ft	0
50ft – 75ft	2	50ft – 75ft	0
25ft – 50ft	0	25ft – 50ft	0
25ft and below	1	25ft and below	1
Subtotal	**9**	**Subtotal**	**1**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	0	100ft and over	0
75ft – 100ft	1	75ft – 100ft	0
50ft – 75ft	0	50ft – 75ft	0
25ft – 50ft	1	25ft – 50ft	0
25ft and below	2	25ft and below	0
Subtotal	**4**	**Subtotal**	**0**
Constructed Tanks[d]			
Tanks	1		
Subtotal	**1**		
Total All Tower Structures		**101**	

Source: (Federal Communications Commission, 2015c)

[a] Planned construction or modification has been completed. Results will return only those antenna structures that the FCC has been notified are physically built or planned modifications/alterations to a structure have been completed (Federal Communications Commission, 2013)

[b] Free standing or guyed structure used for communication purposes (Federal Communications Commission, 2013)

[c] Multiple constructed structures per antenna registration (Federal Communications Commission, 2013)

[d] Any type of tank – water, gas, etc. with a constructed antenna (Federal Communications Commission, 2013)

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

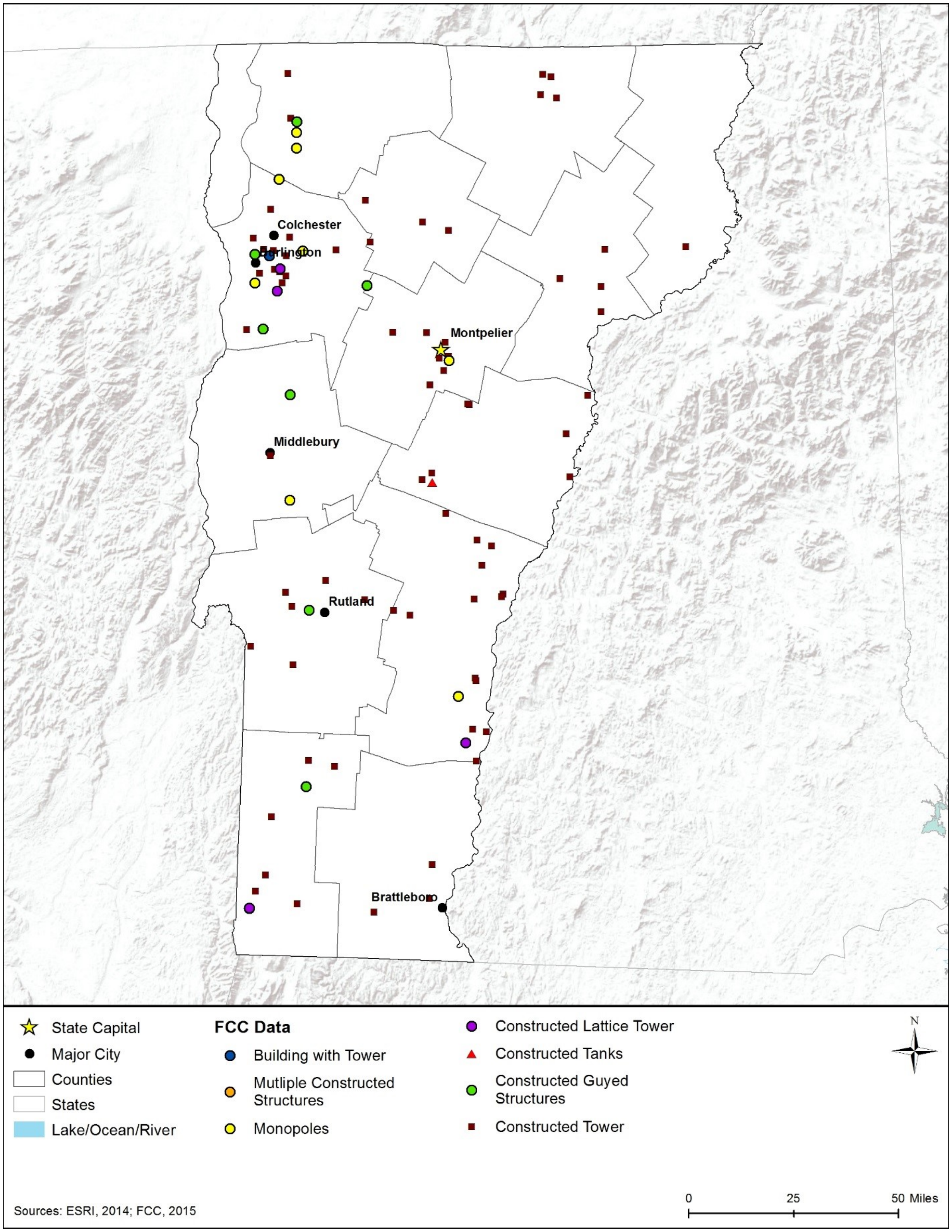
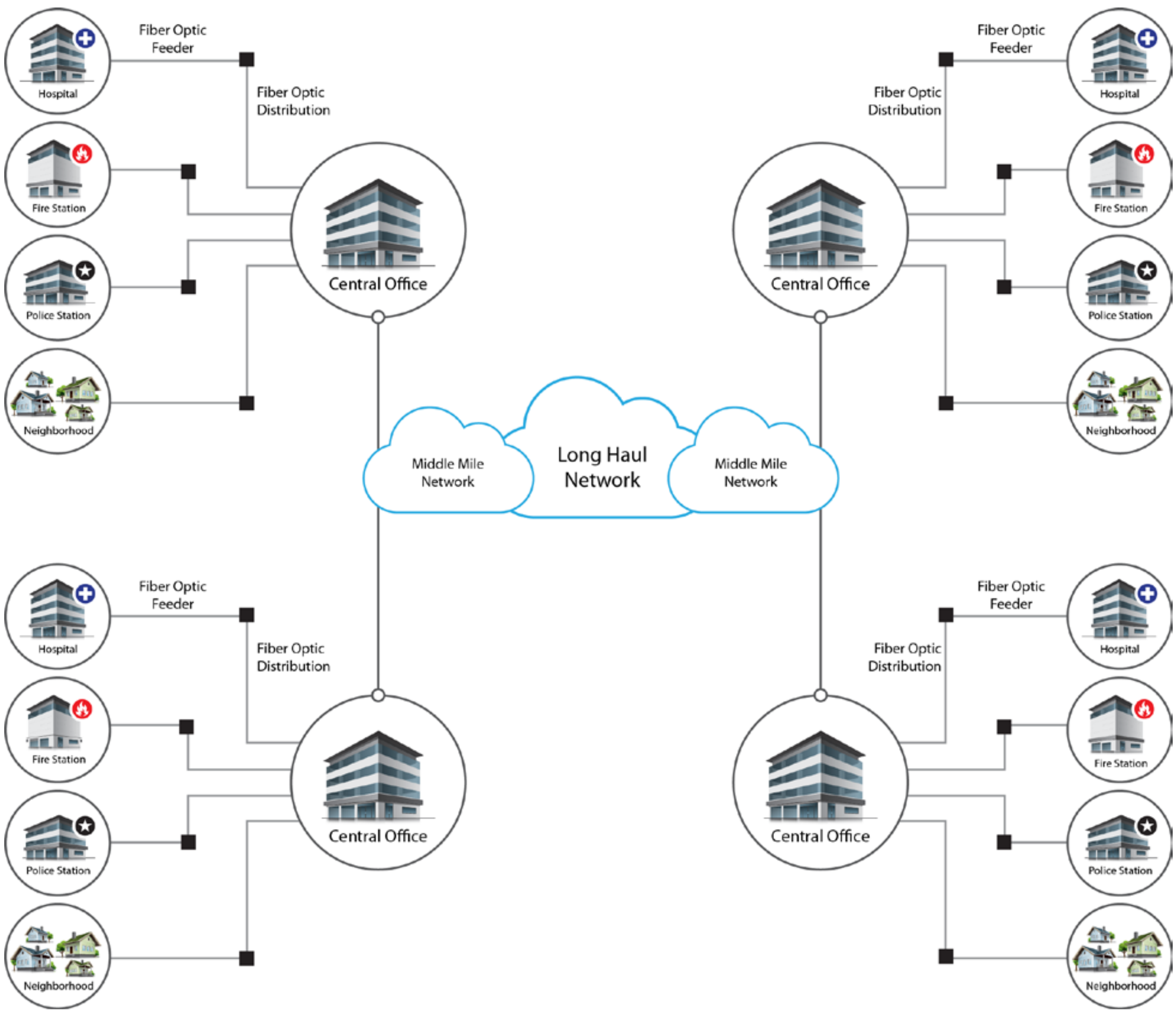


Figure 14.1.1-10: FCC Tower Structure Locations in Vermont

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 Table 14.1.1-11. 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) (Federal Communications Commission, 2000).



Prepared by: Booz Allen Hamilton

Figure 14.1.1-11: Typical Fiber Optic Network in Vermont

Last Mile Fiber Assets

In Vermont, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Vermont, there are 21 fiber providers that offer service in the state, as listed in Table 14.1.1-10. Figure 14.1.1-12 presents coverage provided by FairPoint Communications; Figure 14.1.1-13 presents coverage for other providers; and Figure 14.1.1-14 presents coverage provided by Comcast.

Table 14.1.1-10: Fiber Provider Coverage

Fiber Provider	Coverage
FairPoint Communications	37.54%
Other [a]	20.49%
Comcast	20.06%

Source: (U.S. Department of Commerce, 2014)
[a] Other: Provider with less than 5% coverage area. Providers include: Green Mountain Access; Vermont Telephone Company; Sovernet Communications; Charter Communications Inc; Shoreham Telephone Company; TDS Telecom; EC Fiber; TelJet; Topsham Telephone Company; SegTel; Southern Vermont Cable Company; Level 3 Communications; Franklin Telephone Company, Inc; Duncan Cable; Topsham Communications; Stowe Cablevision; Trans-Video Cable; Burlington Telecom; Smugglet's Notch Water Company

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).

14.1.1.6. Utilities

Utilities are the systems that are essential to support daily operations in a community and cover a broad array of public services, such as electricity, wastewater, and sewage. Section 14.1.4, Water Resources, describes the potable water sources in the state.

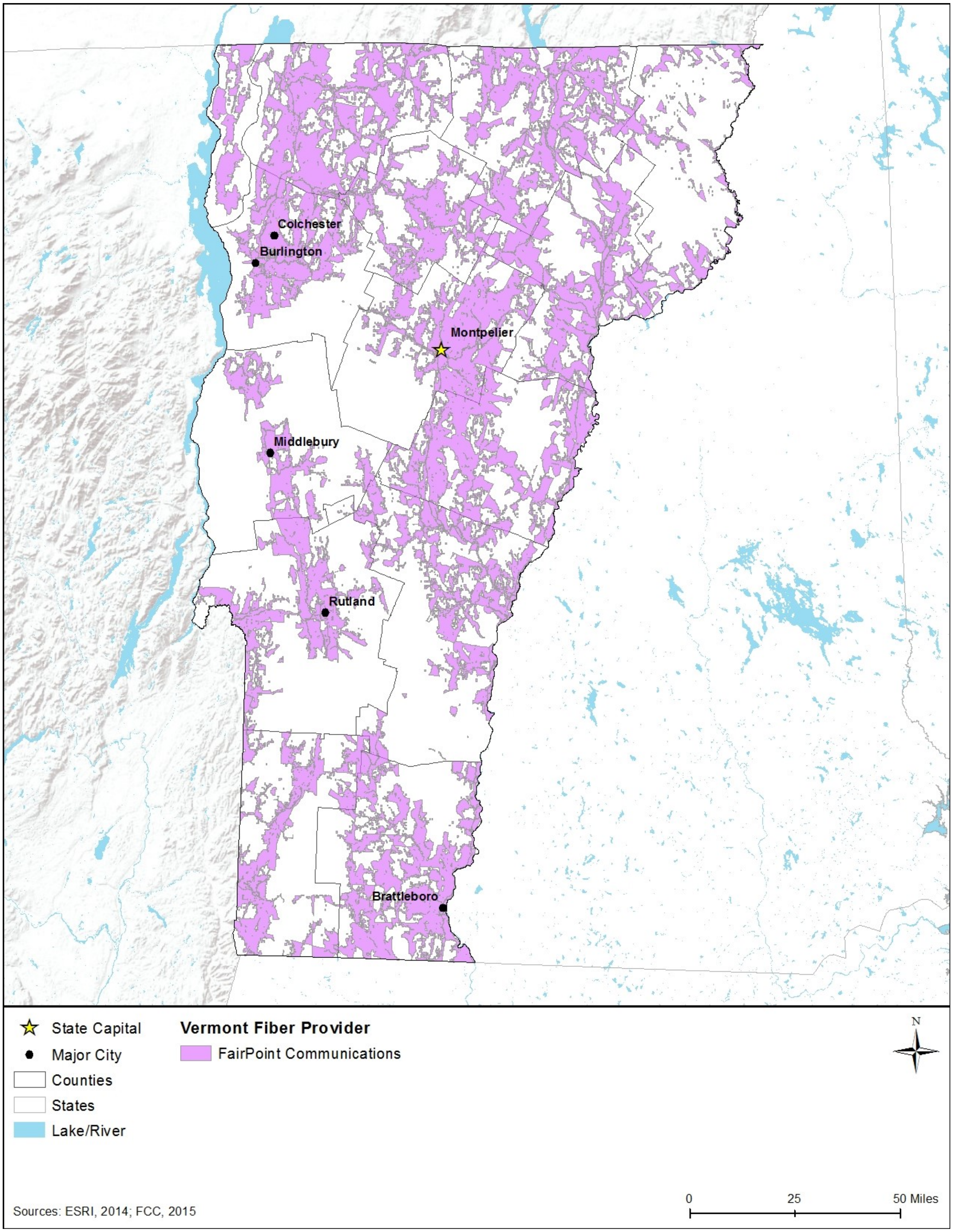


Figure 14.1.1-12: FairPoint Communications Fiber Availability in Vermont

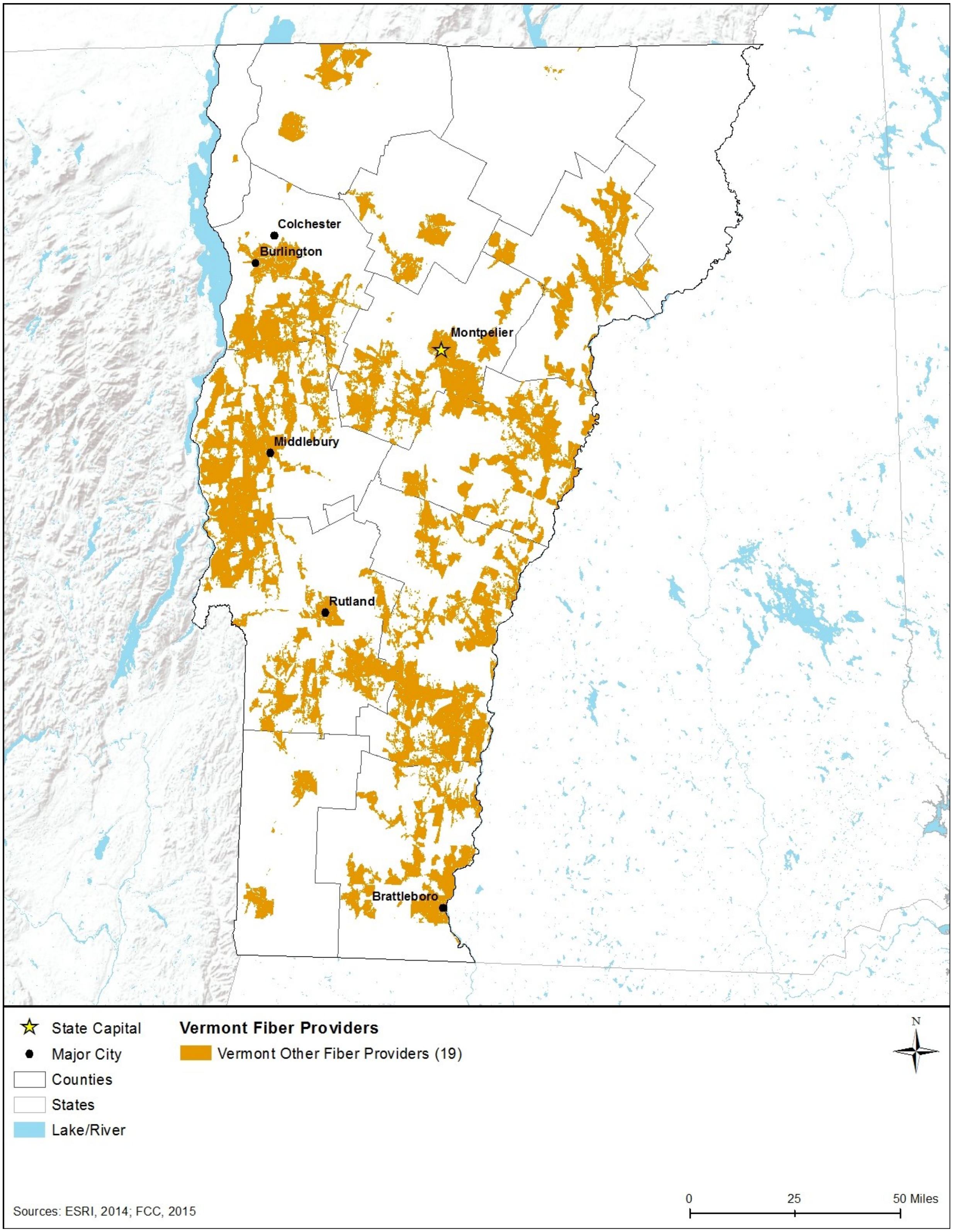


Figure 14.1.1-13: Fiber Availability in Vermont for All Other Coverage Providers

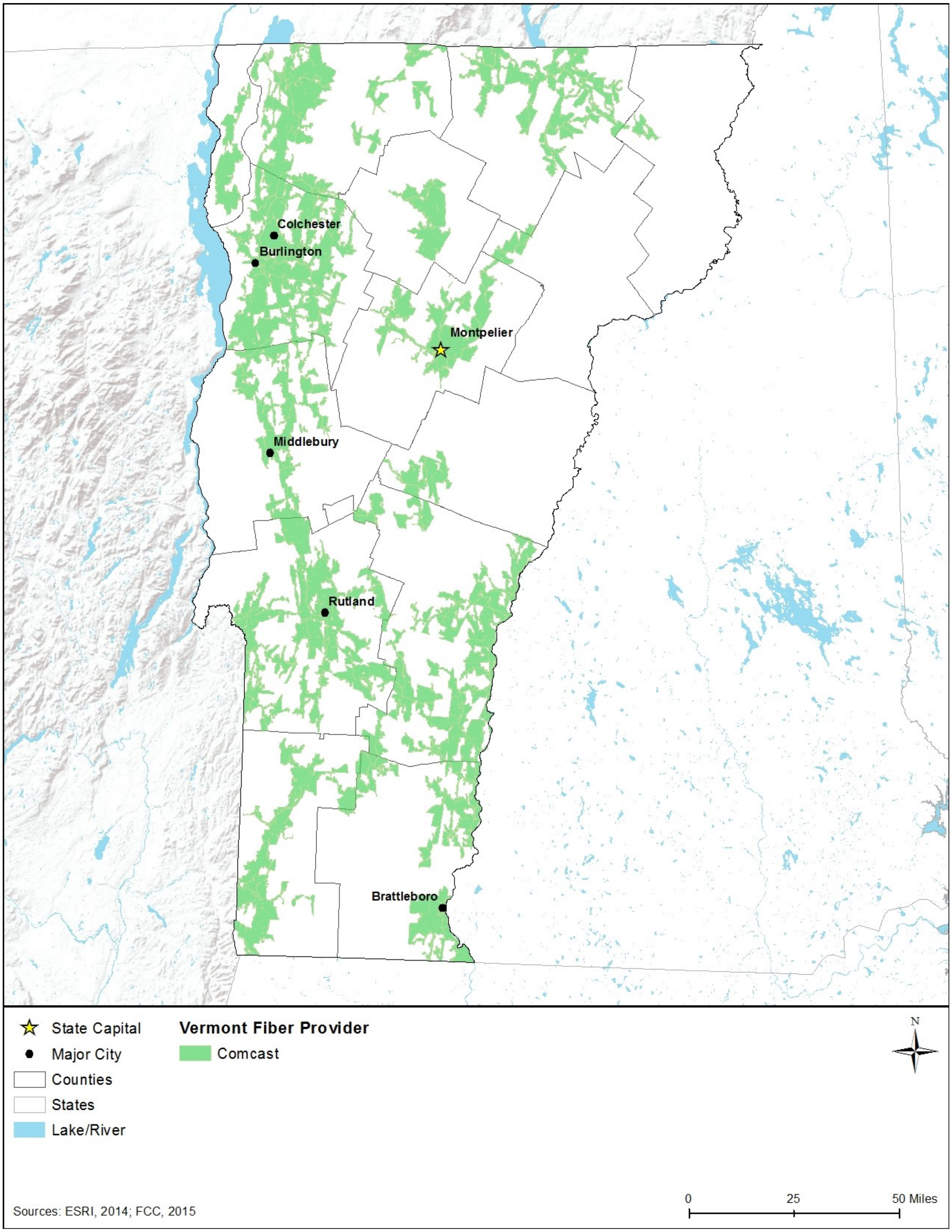


Figure 14.1.1-14: Comcast Fiber Availability in Vermont

Electricity

There are three types of electricity utilities in Vermont, all overseen by the Vermont Public Service Board (PSB). The state's electric utilities can be categorized as municipal electric departments, investor-owned utilities, or member-owned cooperatives in rural communities (Vermont Public Service Department, 2015a). The PSB regulates utility rates and issues Certificates of Public Good (CPG), allowing these companies to operate. Currently, there are 29 companies that have been issued a CPG by the Board. One of these, the Citizens Communications Company, no longer provides service. The remaining 28 utilities offer a variety of distribution, generation, and transmission services (Vermont Public Service Board, 2015). The largest company on this list, Green Mountain Power, is owned by its investors and offers service to over 255,000 customers (Vermont Public Service Department, 2015a).

According to the U.S Energy Information Administration (EIA), nearly all of Vermont's electricity came from nuclear power facilities in recent years. Of the 7,031 megawatts of electricity produced in 2014, 5,061 thousand (72 percent) were generated by nuclear power.[11] A further 1,175 thousand megawatts (17 percent) came from hydroelectric facilities. These have been the major sources of power in Vermont for years, with these trends holding since at least 2001 (U.S. Energy Information Administration, 2015a).

Vermont had a goal of generating 25 percent of its electricity from renewable resources, with the intention of meeting this goal by 2017. Including hydroelectric power, renewable resources accounted for 27 percent of net generation in 2014 (U.S. Energy Information Administration, 2015b), surpassing the goal that had previously been set. At the end of 2014, the Vermont Yankee Nuclear Power Station was disconnected from the electricity grid, decommissioned, and shut down. This facility was the source of much of the state's electricity and had been for many years. The loss of this plant will increase Vermont's reliance on sustainable technologies and resources, as well as fossil fuel plants (Vermont Public Service Department, 2015c). As of December 2015, Vermont had the 9th highest average residential electricity price in the country (U.S. Energy Information Administration, 2015c). In 2013, 36.8 percent of the electricity sold went to use by the transportation sector (U.S. Energy Information Administration, 2015d).

Water

There are 37 water utility companies authorized to conduct business by the Vermont PSB. Twelve of these are likely closed, as their addresses no longer accept mail from the Board (Vermont Public Service Department, 2015d). The Drinking Water and Groundwater Protection Division oversees public drinking water and groundwater withdrawals. This includes public community water systems, public non-transient non-community water systems (such as schools or office buildings), and public transient non-community water systems (such as campgrounds or restaurants) (DEC, 2015a). Publicly supplied drinking water must be laboratory tested periodically to ensure its safety. Among the contaminants tested for are cyanobacteria; coliform

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[11] One Megawatt (MW) can be defined as "One million watts of electricity," where one watt is "the unit of electrical power equal to one ampere under a pressure of one volt. A Watt is equal to 1/746 horse power." (U.S. Energy Information Administration, 2015e)

bacteria; lead; copper; disinfectant residues such as chlorine; manganese; and a host of other potentially harmful substances with water quality reports found online for review (DEC, 2015b).

Wastewater

Depending on the location of discharge, wastewater in Vermont is regulated by one of two organizations. Wastewater that is discharged underground is regulated by the Drinking Water and Groundwater Protection Division. The Watershed Management Division deal with wastewater that is discharged into surface waters. It also deals with waters discharged into municipal systems for collection (DEC, 2015c).

The Drinking Water and Groundwater Protection Division is segmented into regional offices that issue permits for a variety of wastewater disposal arrangements. Among these are permits that allow additional connections to or extensions of municipal sewer systems (DEC, 2015d). It also permits and regulates Underground Injection Controls (UICs), also known as floor drains. These are large scale repositories of fluid waste, often from an industrial source such as engine repair, dry cleaning, or salvage yards. Due to the risk of leakage into drinking water supplies, high risk "…floor drains which discharge to the subsurface are prohibited and must therefore be 'closed.'" This involves either plugging the drain with concrete or connecting it to a holding tank or sewer (DEC, 2015e).

The Watershed Management Division offers permits for the National Pollutant Discharge Elimination System (NPDES), which regulates discharges into state surface water. They also issue Federal Pretreatment Permits for facilities that discharge into municipal wastewater streams (DEC, 2015f). The disposal of residuals like septage and wastewater sludge are also overseen by the Watershed Management Division. These materials can be disposed of in landfills or incineration facilities, or alternately may be treated and used on land as fertilizer for certain types of crops, within state restrictions (DEC, 2015g). The Watershed Management Division also issues permits that certify operators to work at wastewater treatment facilities in Vermont (DEC, 2015c).

Solid Waste Management

Vermont's solid waste program "…regulates solid waste management facilities and activities and certifies the state's landfills, transfer stations, haulers, composting, and recycling facilities…" (DEC, 2015h). In 2013, the state had six landfills that held permits for waste acceptance. The largest of these, owned by New England Waste Services, had a capacity of 450,000 tons/year. In the same year, approximately 116,147 tons of waste was disposed of in facilities outside of the state, mostly in New Hampshire and New York (DEC, 2015i). In 2013, 393,438 of 619,065 tons of waste generated in Vermont were disposed of; the remaining 225,627 tons were diverted, through recycling, composting, or other means (DEC, 2015j). The state's 232 solid waste facilities are a mixture of landfills, recycling facilities, transfer stations, and composting facilities (DEC, 2015k). The Vermont Universal Recycling Law bans the disposal of recyclable materials in landfills, leaf and yard debris, and food scraps. Solid waste facilities are required to accept these materials, aiding in their recycling or composting.

14.1.2. Soils

14.1.2.1. 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." (Natural Resources Conservation Service, 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." (Natural Resources Conservation Service, 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.

14.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. Applicable federal laws and regulations that apply for Soils, such as the Farmland Protection Policy Act of 1981, are in Appendix C. A list of applicable state laws and regulations is included in Table 14.1.2-1 below.

Table 14.1.2-1: Relevant Vermont Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Vermont Standards and Specifications for Erosion Prevention and Sediment Control	Vermont Department of Environmental Conservation	An Erosion Prevention and Sediment Control Plan is required for projects that discharge stormwater from construction sites (VTrans 2006).

14.1.2.3. Environmental Setting

Vermont is composed of one Land Resource Region (LRR),[12] the Northeastern Forage and Forest Region, as defined by the Natural Resources Conservation Service (NRCS) (Natural Resources Conservation Service, 2006). Within and among Vermont's one LRR are five Major Land Resource Areas (MLRA),[13] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming. The locations and characteristics of Vermont's MLRAs are presented in and Table 14.1.2-2, 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[14] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[15] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky, & Rogers, 2004). Soils can also be affected by a variety of surface uses that loosen topsoil and damage or remove vegetation or other groundcover, which may result in accelerated erosion, compaction, and rutting[16] (discussed further in the subsections below).

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

Table 14.1.2-2: Characteristics of Major Land Resource Areas in Vermont

MLRA Name	Region of State	Soil Characteristics
Connecticut Valley	Eastern Vermont	Entisols[a] and Inceptisols[b] are the dominant soil orders in this area, and the soils in this area are generally very deep, excessively drained to poorly drained, and clayey, loamy, or sandy.
New England and Eastern New York Upland, Northern Part	Eastern and Northern Vermont	Dominant soil orders in this MLRA are Inceptisols and Spodosols,[c] 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 Vermont	Dominant soil orders in this MLRA include Entisols, Histosols,[d] and Inceptisols, and the soils are generally very deep, somewhat excessively drained to poorly drained, and loamy or sandy.
Northeastern Mountains	Central and Northeastern Vermont	Inceptisols and Spodosols are dominant soil orders in this MLRA. The soils in this area are shallow to very deep, generally somewhat excessively drained to poorly drained, also loamy.
St. Lawrence-Champlain Plain	Northwestern Vermont	Alfisols,[e] Inceptisols, Spodosols, and Entisols are the dominant soil orders in this MLRA. Ranging from shallow to very deep, these sandy to clayey soils are excessively drained to very poorly drained.

Source: (Natural Resources Conservation Service, 2006)

[a] 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 floodplains 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." (Natural Resources Conservation Service, 2015b)

[b] 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." (Natural Resources Conservation Service, 2015b)

[c] 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." (Natural Resources Conservation Service, 2015b)

[d] 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." (Natural Resources Conservation Service, 2015b)

[e] Alfisols: "Soils [that] result from weathering processes that leach clay minerals and other constituents from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil, where they can hold and supply moisture and nutrients to plants. They formed primarily under forest or mixed vegetative cove and are productive for most crops." (Natural Resources Conservation Service, 2015b)

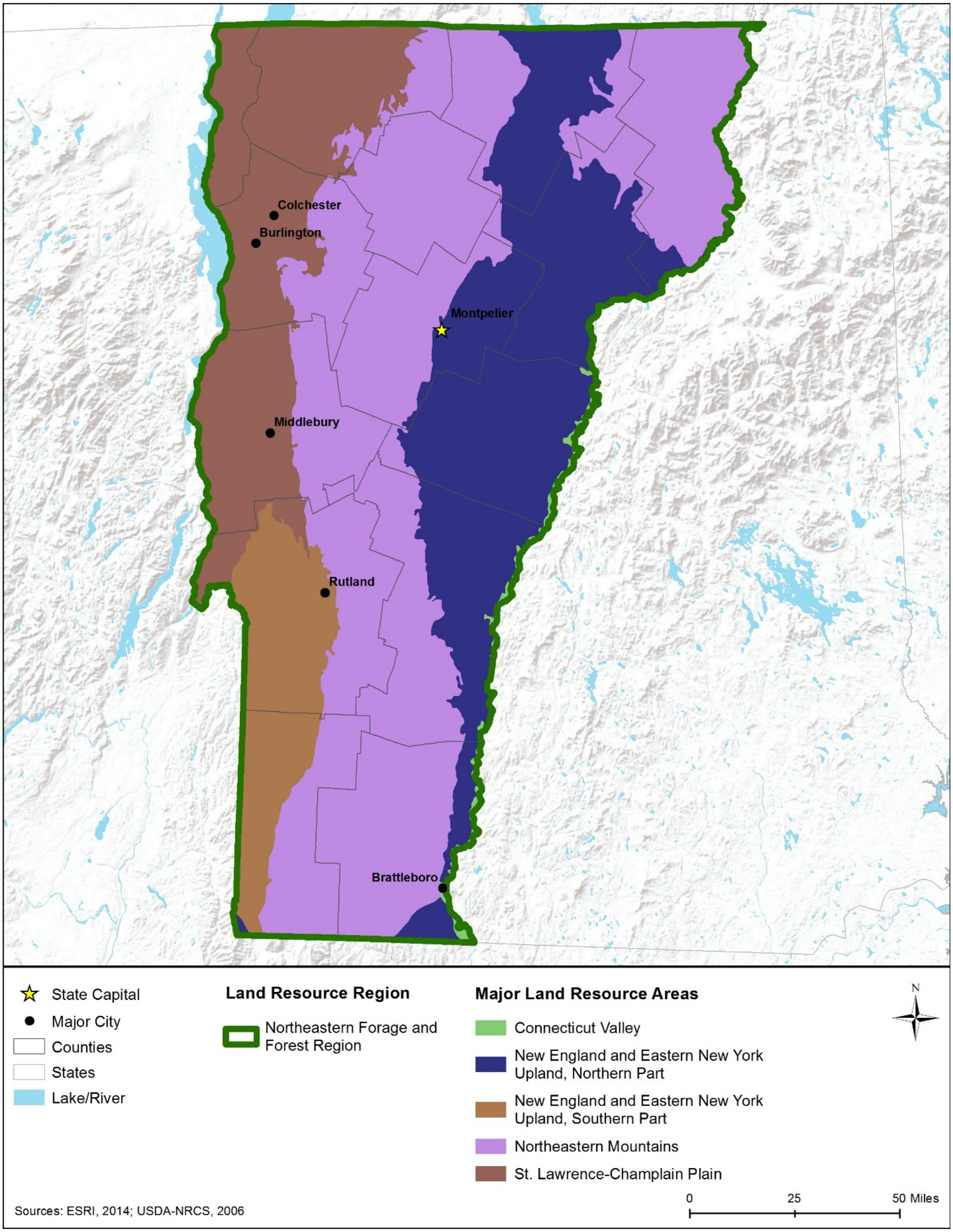

Figure 14.1.2-1: Locations of Major Land Resource Areas in Vermont

14.1.2.4. Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy[17]; there are twelve soil orders in the world and they are characterized by both observed and inferred[18] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (Natural Resources Conservation Service, 2015c).

14.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[19] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 14.1.2-3 provides a summary of the runoff potential for each soil suborder in Vermont.

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

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. Fluvents, Orthods, and Udepts fall into this category in Vermont.

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. Aquepts, Cryods, Humods, Orthods, Udalfs, and Udepts fall into this category in Vermont.

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

[17] Science of naming and classifying organisms or specimens
[18] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)" (Natural Resources Conservation Service, 2015d)
[19] Classifying soils is highly generalized and it is challenging to differentiate orders as soil properties can change with distance or physical properties. The soil suborders are at a high level, therefore soil groups may be found in multiple hydrologic groups within a state, as composition, topography, etc. varies in different areas.
[20] Infiltration Rate: "The rate at which a soil under specified conditions absorbs falling rain, melting snow, or surface water expressed in depth of water per unit time." (Federal Emergency Management Agency, 2010)

14.1.2.6. Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (Natural Resources Conservation Service, 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 (Natural Resources Conservation Service, 1996a). Table 14.1.2-3 (above) provides a summary of the erosion potential for each soil suborder in Vermont. Soils with the highest erosion potential in Vermont include those in the Aqualfs, Aquepts, Cryods, Fluvents, Hemists, Humods, Orthods, Udalfs, and Udepts suborders, which are found throughout most of the state (Figure 14.1.2-2).

14.1.2.7. 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 (Natural Resources Conservation Service, 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, 2009a). Other characteristics that factor into compaction and rutting risk include soil composition (i.e. low organic soil is at increased risk of compaction), amount of pressure exerted on the soil, and repeatability (i.e., the number of times the pressure is exerted on the soil). Machinery and vehicles that have axle loads greater than ten tons can cause soil compaction of greater than 12 inches depth (Natural Resources Conservation Service, 1996b), (Natural Resources Conservation Service, 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 (Natural Resources Conservation Service, 1996b). Table 14.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Vermont. Soils with the highest potential for compaction and rutting in Vermont include those in the Aqualfs, Aquepts, and Hemists suborders, which are found throughout the state (Figure 14.1.2-2).

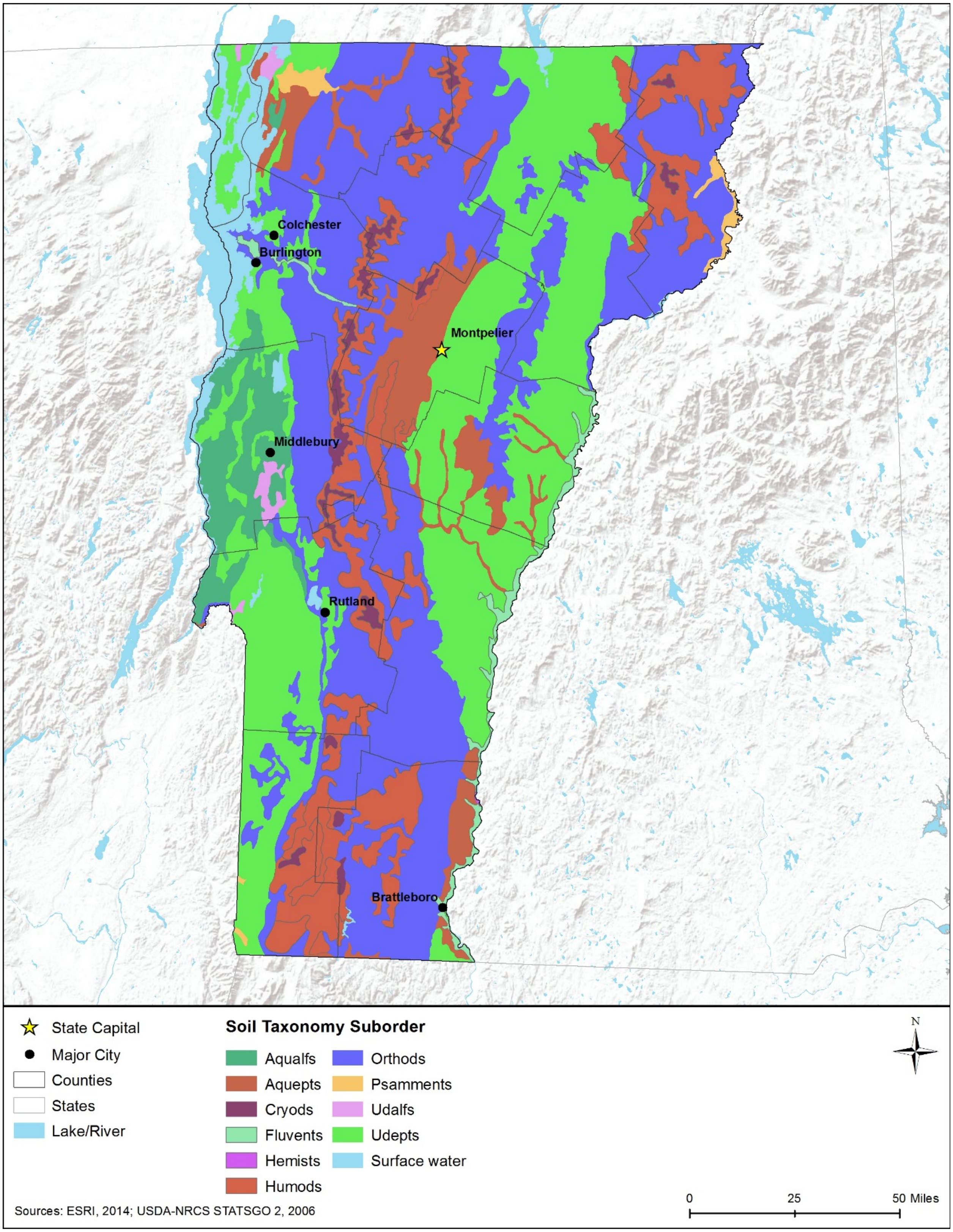

Figure 14.1.2-2: Vermont Soil Taxonomy Suborders

Table 14.1.2-3: Major Characteristics of Soil Suborders Found in Vermont, as depicted in Figure 14.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[21]	Hydrologic Group	Runoff Potential	Permeability[22]	Erosion Potential	Compaction and Rutting Potential
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Used as cropland; most have some artificial drainage or other water control. Nearly all Aqualfs have supported forest vegetation in the past.	Silty clay	0-2	Poorly drained	Yes	D	High	Very Low	High	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 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.	Fine sandy loam, loam, sandy loam, silt loam, silty clay loam, very fine sandy loam	0-15	Poorly drained	Yes	C, D	Medium to High	Low to Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Spodosols	Cryods	Cryods are soils of high latitudes and/or high elevations, with coniferous forest vegetation, and used as forest or wildlife habitat.	Very cobbly fine sandy loam	25-50	Well drained	No	C	Medium	Low	Medium	Low
Entisols	Fluvents	Fluvents are mostly freely drained soils that form in recently deposited sediments on floodplains, fans, and deltas along rivers and streams. Unless protected by dams or levees, these soils frequently flood. Fluvents are normally utilized as rangeland, forest, pasture, or wildlife habitat, or cropland.	Silt loam, very fine sand	0-3	Moderately well drained to well drained	No	B	Medium	Moderate	Medium	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	0-2	Very poorly drained	Yes	A, D	Low to High	High to Very Low	Low to High, depending on slope	High, due to hydric soil and poor drainage conditions
Spodosols	Humods	Humods are typically formed under coniferous forest vegetation, and utilized mostly as forest. They are relatively freely drained.	Gravelly fine sandy loam, loamy fine sand	8-50	Well drained	No	C	Medium	Low	Medium	Low
Spodosols	Orthods	Orthods have a moderate accumulation of organic carbon, and are relatively freely drained. Most of these soils are either used as forest or have been cleared and are used as cropland or pasture. Although they are naturally infertile, they can be highly responsive to good management.	Fine sandy loam, gravelly fine sandy loam, gravelly loam, gravelly loamy sand, gravelly sandy loam, loam, sandy loam, silt loam, unweathered bedrock, very fine sandy loam, very gravelly sand, very gravelly sandy loam	0-50	Moderately well drained to excessively drained	No	A, B, C, D	Low to High	High to Very Low	Low to High, depending on slope	Low
Entisols	Psamments	Psamments are sandy in all layers. In some arid and semi-arid climates, they are among the most productive rangeland soils, and are primarily used as rangeland, pasture, or wildlife habitat. Those Psamments that are nearly bare are subject to wind erosion and drifting, and do provide good support for wheeled vehicles.	Loamy fine sandy, loamy sand	0-25	Excessively drained	No	A	Low	High	Low	Low
Alfisols	Udalfs	Udalfs have a udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Clay, silty clay	2-35	Moderately well drained	No	C	Medium	Low	Medium	Low
Inceptisols	Udepts	Udepts have an udic or perudic (saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the Northwest and mixed or hardwood forest in the East. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture.	Channery silt loam, channery silty clay loam, fine sandy loam, gravelly fine sandy loam, gravelly sandy loam, loam, sandy loam, silt loam, silty clay loam, unweathered bedrock	0-70	Moderately well drained to somewhat excessively drained	No	A, B, C, D	Low to High	High to Very Low	Low to High, depending on slope	Low

Source: (Natural Resources Conservation Service, 2015g) (Natural Resources Conservation Service, 1999)

[21] 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" (Natural Resources Conservation Service, 2015f).
[22] Based on Runoff Potential, described in Section 14.1.2.5.

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14.1.3. Geology

14.1.3.1. 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 14.2.4), Human Health and Safety (Section 14.2.15), and Climate Change (Section 14.1.14).

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

- Section 14.1.3.3, Major Physiographic Regions and Provinces[23,24]
- Section 14.1.3.4, Surface Geology
- Section 14.1.3.5, Bedrock Geology[25]
- Section 14.1.3.6, Paleontological Resources[26]
- Section 14.1.3.7, Fossil Fuel and Mineral Resources
- Section 14.1.3.8, Potential Geologic Hazards[27]

14.1.3.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the NEPA and other applicable laws and regulations. Applicable federal laws and regulations that apply to Geology, such as the National Historic Preservation Act and the Clean Water Act, are detailed in Appendix C. A list of applicable state laws and regulations is included in Table 14.1.3-1 below.

Table 14.1.3-1: Relevant Vermont Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
VTrans Structures Design Manual[28]	Vermont Agency of Transportation	Bridges must be designed with consideration of seismic motion

14.1.3.3. 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

[23] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology. (Fenneman, 1916)
[24] Physiographic provinces: Subsets within physiographic regions. (Fenneman, 1916)
[25] Bedrock: Solid rock beneath the soil and superficial rock. (U.S. Geological Survey, 2015b)
[26] Paleontology: "Study of life in past geologic time based on fossil plants and animals." (U.S. Geological Survey, 2015c)
[27] 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." (National Park Service, 2013)
[28] (Vermont Natural Resources Board, 2010)

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)

Vermont is entirely within the Appalachian Highlands Physiographic Region and three physiographic provinces: the St. Lawrence Valley, New England, and Valley and Ridge Provinces. To characterize differences in physiography across the state and to better support PEIS tiering, the physiographic sections for each province are summarized below.

Appalachian Highlands Region

The Appalachian Highlands Region extends from Canada to Alabama. This region is composed of layers of folded sedimentary rock,[29] 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,[30] 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. (U.S. Geological Survey, 2003a)

As reported above, the Appalachian Highlands Region within Vermont is composed of three physiographic provinces: St. Lawrence Valley, New England, and Valley and Ridge Provinces (U.S. Geological Survey, 2003a).

<u>St. Lawrence Valley Province</u> – The St. Lawrence Valley Province, which includes the Champlain section in western Vermont, spans the entire length of western Vermont from north to south. This area is noted for its flat topography, which is interrupted with sporadic hills (Doolan, 1996). Elevations throughout the Province range from sea level to more than 300 feet ASL. The St. Lawrence Valley is composed of soft Cambrian (542 to 488 MYA) and Ordovician (488 to 444 MYA) sedimentary rocks (e.g., shale,[31] dolomite,[32] and limestone[33]) (Denny, 1982). These sedimentary rocks are noteworthy for the volume and size of animal fossils that they preserve (Doolan, 1996).

[29] 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." (U.S. Geological Survey, 2014a)
[30] The Rocky Mountains exceed 14,000 feet above sea level (U.S. Geological Survey, 2014a).
[31] Shale: "Sedimentary rock derived from mud. Commonly finely laminated (bedded). Particles in shale are commonly clay minerals mixed with tiny grains of quartz eroded from pre-existing rocks." (U.S. Geological Survey, 2015d)
[32] Dolomite: "A magnesium-rich carbonate sedimentary rock." (U.S. Geological Survey, 2015d)
[33] Limestone: "A sedimentary rock made mostly of the mineral calcite (calcium carbonate). Limestone is usually formed from shells of once-living organisms or other organic processes, but may also form by inorganic precipitation. (U.S. Geological Survey, 2015d)

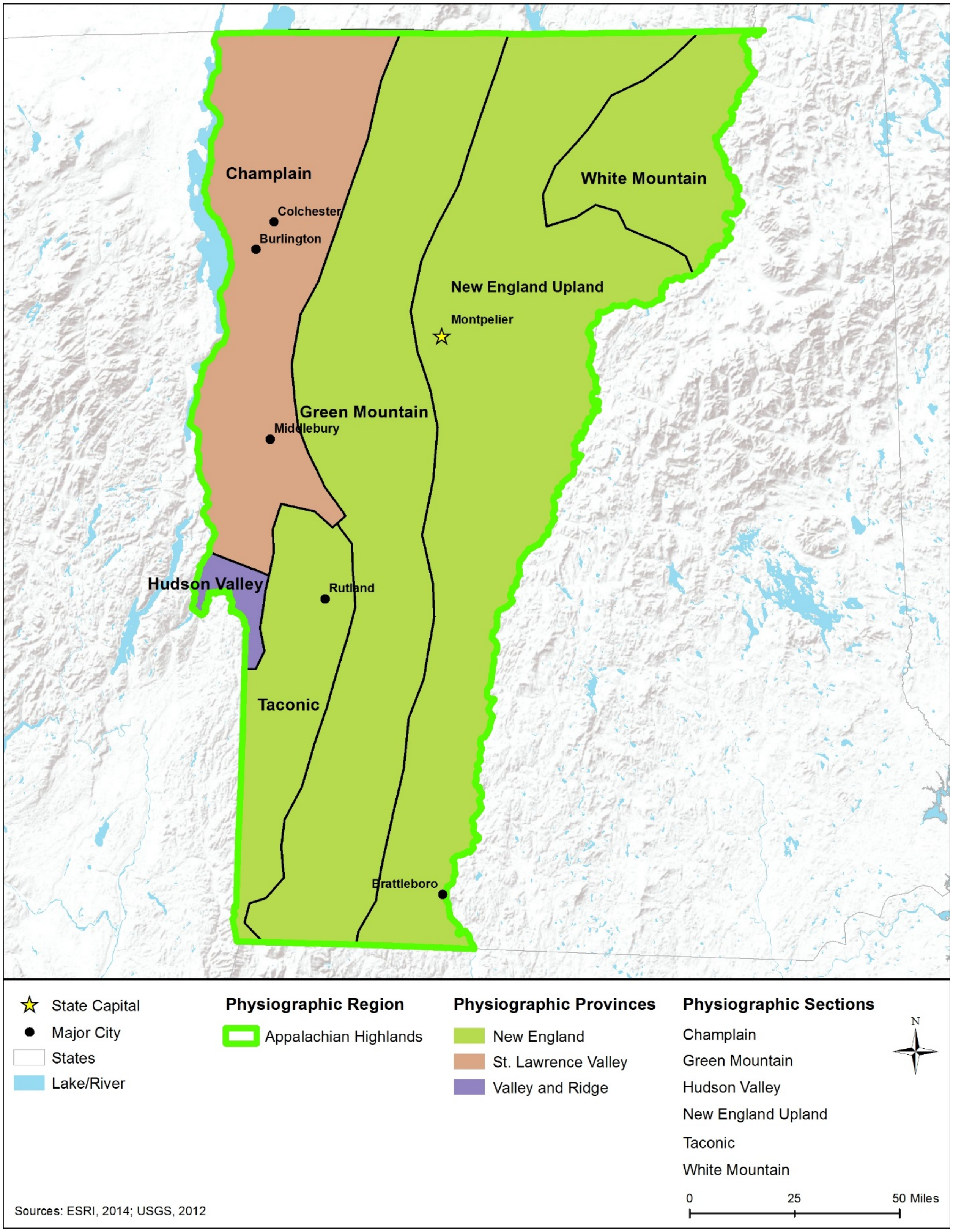

Figure 14.1.3-1: Physiographic Regions, Provinces, and Sections of Vermont

New England Province – The New England Province is composed of four physiographic sections within Vermont: the Taconic section, Green Mountain section, White Mountain section, and New England Upland section. In Vermont, the Taconic section arises near the Rutland-Addison County line and stretches to the New York border (Dale, 1905). The Taconic Mountains were created during the Taconic orogeny 440 MYA and are underlain by highly deformed metamorphic rocks that were also folded and faulted during the Acadian (375 to 325 MYA) and Alleghenian (325 to 260 MYA) orogenies[34] (U.S. Geological Survey, 2015e). Peaks range from 1,500 to 2,500 ASL throughout this area of Vermont.

Vermont's Green Mountain section spans the entire length (from north to south) of the central part of the state. They are underlain by Precambrian metamorphic rocks[35] (e.g., schist[36]), some of which are more than 1 billion years old. "The Green Mountain range includes the highest peaks in the State, culminating in such elevations as Mount Mansfield (4393 ft.), Killington (4241 ft.), Mount Ellen (4135 ft.), and Natural Setting n Camel's Hump (4083 ft.)." (Workers of the Federal Writers' Project of the Works Progress Administration for the State of Vermont, 1976).

The White Mountain section encompasses the extreme northeastern portion of Vermont. The southern and western borders of the White Mountain section intersect with the New England Upland in the northeastern portion of the state. The White Mountain section rises from 1,500 feet ASL and, in most cases, topographic relief is between 500 and 1,500 feet; in a few locations topographic relief can exceed 3,500 feet. (U.S. Geological Survey, 1999).

The New England Upland section extends from Vermont's southern border with Massachusetts to its northern border with Canada in the eastern portion of the state (Lobeck, 1917). The section is described as "an area of undulating hilly topography, ranging in elevation from below 1,000 feet to above 2,000 feet." (Lobeck, 1917). Fenneman described the New England Upland section "as an upraised peneplain[37] with sporadic hills dissected by narrow valleys." (U.S. Geological Survey, 1999)

Valley and Ridge Province – The Valley and Ridge Province, including the Hudson Valley section, includes a small area of western Vermont just south of the St. Lawrence Valley Province. The Hudson Valley is bordered to the east by the Taconic section in Vermont; this section stretches as far south as New Jersey to the Delaware River. (USFWS, 2015a)

[34] Orogeny: a process in which a section of the earth's crust is folded and deformed by lateral compression to form a mountain range.
[35] 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." (U.S. Geological Survey, 2015d)
[36] Schist: "Metamorphic rock usually derived from fine-grained sedimentary rock such as shale. Individual minerals in schist have grown during metamorphism so that they are easily visible to the naked eye." (U.S. Geological Survey, 2015d)
[37] Peneplain: A land surface flat landscape that is the "ultimate stage in the cycle of erosion." (U.S. Geological Survey, 2013a)

14.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[38] 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,[39] subsidence,[40] and erosion. (Thompson, 2015)

All of Vermont was covered during the Pleistocene glaciation that ended roughly 13,000 years ago (Ray, 1992); ice thickness during the Pleistocene Ice Age likely exceeded a mile (Doolan, 1996), and may have been upwards of two miles (National Park Service, 2015a). Throughout Vermont, glacial till covers the landscape at depths that can exceed 100 feet (Stewart & MacClintock, 1969). Few moraines[41] are documented in Vermont due to the variable nature of the underlying topography (Stewart & MacClintock, 1969). The extent of erosion due to glaciation in Vermont is responsible for the thin soil layers present today throughout the state (National Park Service, 2015a). In western Vermont, glacial recession and melting flooded the entirety of the Champlain Valley with the modern day Lake Champlain serving as a remnant of this event (Doolan, 1996).

Figure 14.1.3-2**Error! Reference source not found.** shows the extent of surface geology deposits for Vermont.

14.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (U.S. Geological Survey, 2015f) reveals important information about a region's surface and subsurface characteristics (i.e., 3-dimensional geometry), including dip (slope of the formation),[42] rock composition, and regional tectonism[43]. 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 (NH DES, 2014).

Most of Vermont's rocks are Precambrian (older than 542 MYA) and Paleozoic (542 MYA to 251 MYA) metamorphic and sedimentary rocks; minimal igneous rocks[44] occur in the state

[38] 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." (U.S. Geological Survey, 2013a)
[39] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses.
[40] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." (U.S. Geological Survey, 2000)
[41] Moraine: "A hill-like pile of rock rubble located on or deposited by a glacier." (U.S. Geological Survey, 2015d)
[42] 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." (National Park Service, 2000)
[43] Tectonicisms: “Structure forces affecting the deformation, uplift, and movement of the earth’s crust.” (U.S. Geological Survey, 2015g)
[44] Igneous Rocks: "Rock formed when molten rock (magma) that has cooled and solidified (crystallized)." (U.S. Geological Survey, 2015d)

(Vermont Geological Survey, 1970). An overview of the underlying geology of each physiographic section is included below and in Figure 14.1.3-3.

- The Champlain Valley section in western Vermont is underlain largely by sedimentary rocks (e.g., shale, dolomite, and limestone) from the Cambrian (542 MYA to 488 MYA) and Ordovician (488 MYA to 444 MYA) Periods. In a few areas, Precambrian (older than 542 MYA) metamorphic rocks,[45] including gneiss[46] and quartzite,[47] are observed. (Vermont Geological Survey, 1970)
- The Taconic Mountain section in the southwestern corner of Vermont is made up of metamorphic rocks (e.g., slate, quartzite, marble[48]) from Cambrian and Ordovician Periods. To a lesser extent, sedimentary rocks are found in this area of the state (Vermont Geological Survey, 1970).
- The Green Mountain section is dominated by metamorphic rocks of Precambrian, Cambrian, and Ordovician ages (Vermont Geological Survey, 1970); these rocks are the "metamorphosed equivalents of ancient sediments, lava flows, and slivers of ancient oceanic crust and mantle (Doolan, 1996)." The Precambrian rocks are the oldest rocks in the state (Workers of the Federal Writers' Project of the Works Progress Administration for the State of Vermont, 1976).
- The White Mountain section in eastern Vermont is underlain by metamorphic bedrocks, including quartzite, greenstone,[49] schist, gneiss, and slate) from the Ordovician Period. Igneous rocks, including granite and basalt, have intruded into the White Mountains in some locations. (Vermont Geological Survey, 1970)

For more site-specific information, other sources from the Vermont Geological Survey[50], county soil surveys, and USGS topographical maps[51] should be consulted. Additionally, more detailed studies may be available for specific areas from the USGS, county soil and water conservation districts, and local academic institutions.

[45] Metamorphic Rocks: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids." (U.S. Geological Survey, 2015d)
[46] Gneiss: "A coarse-grained, foliated metamorphic rock that commonly has alternating bands of light and dark-colored minerals." (U.S. Geological Survey, 2015d)
[47] Quartzite: "Hard, somewhat glassy-looking rock made up almost entirely of quartz." (U.S. Geological Survey, 2015d)
[48] Marble: "A metamorphic rock of made of calcium carbonate. Marble forms from limestone by metamorphic recrystallization." (U.S. Geological Survey, 2015d)
[49] Greenstone: "A metamorphic rock derived from basalt or chemically equivalent rock such as gabbro. Greenstones contain sodium-rich plagioclase feldspar, chlorite, and epidote, as well as quartz." (U.S. Geological Survey, 2015d)
[50] http://www.anr.state.vt.us/dec/geo/vgs.htm
[51] http://www.usgs.gov/pubprod/

14.1.3.6. Paleontological Resources

Between the late Precambrian Era through the Devonian Period (roughly 600 MYA through 359 MYA), Vermont was covered by shallow seas yielding assorted marine fossils from this time. Few fossils exist from the Carboniferous Period (359 to 299 MYA), as mountain-building and erosion dominated the Vermont landscape. By the beginning of the Quaternary Period (2.6 MYA to Present), Vermont was covered with ice. Oceans infiltrated areas where the land surface was sufficiently compressed by the weight of the ice (Paleontology Portal, 2015); when the ice retreated 10,000 years ago, waters flooded the St. Lawrence and Champlain valleys, creating Lake Champlain (University of Vermont, 2015). Numerous marine fossils have been recorded from this area (Paleontology Portal, 2015).

Vermont State Fossil
Charlotte Whale Fossil

Source: (University of Vermont, 2009b)

The Charlotte Whale Fossil, Perkins Geology Museum, University of Vermont
© Jeff Howe

Vermont's fossils are most prominent in the western portion of the state in the Champlain Valley (). Paleozoic marine fossils in the Champlain Valley include corals, trilobites, cephalopods and gastropods, bryozoans, and graptolites. Trace fossils, including trilobite tracks and worm borrows, also have been found. Pleistocene Epoch (2.6 MYA to 11,700 years ago) fossils in the Champlain Valley include ancestors of the beluga whale, salmon, seals, elk, mammoth, caribou, weasels, and rabbits (Howe, 1993). An 11,500-year-old beluga whale skeleton was found in Western Vermont in 1849 and has been designated as the state fossil. (University of Vermont, 2009a).

14.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

Vermont does not produce petroleum or natural gas. The state relies on imports of these products from other areas. (U.S. Energy Information Administration, 2015b)

Minerals

As of 2015, Vermont's nonfuel mineral production was valued at $118M, ranking 23rd in the nation by total value. The state's leading nonfuel mineral commodities (in descending order of production value) were crushed stone, construction sand and gravel, and dimension stone[52] (U.S. Geological Survey, 2016); crushed stone and dimension stone accounted for about 99 percent of Vermont's nonfuel mineral production for 2011. Vermont is one of three talc producing states in the country. (U.S. Geological Survey, 2015h)

[52] Dimension stone: "Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape." (U.S. Geological Survey, 2015i)

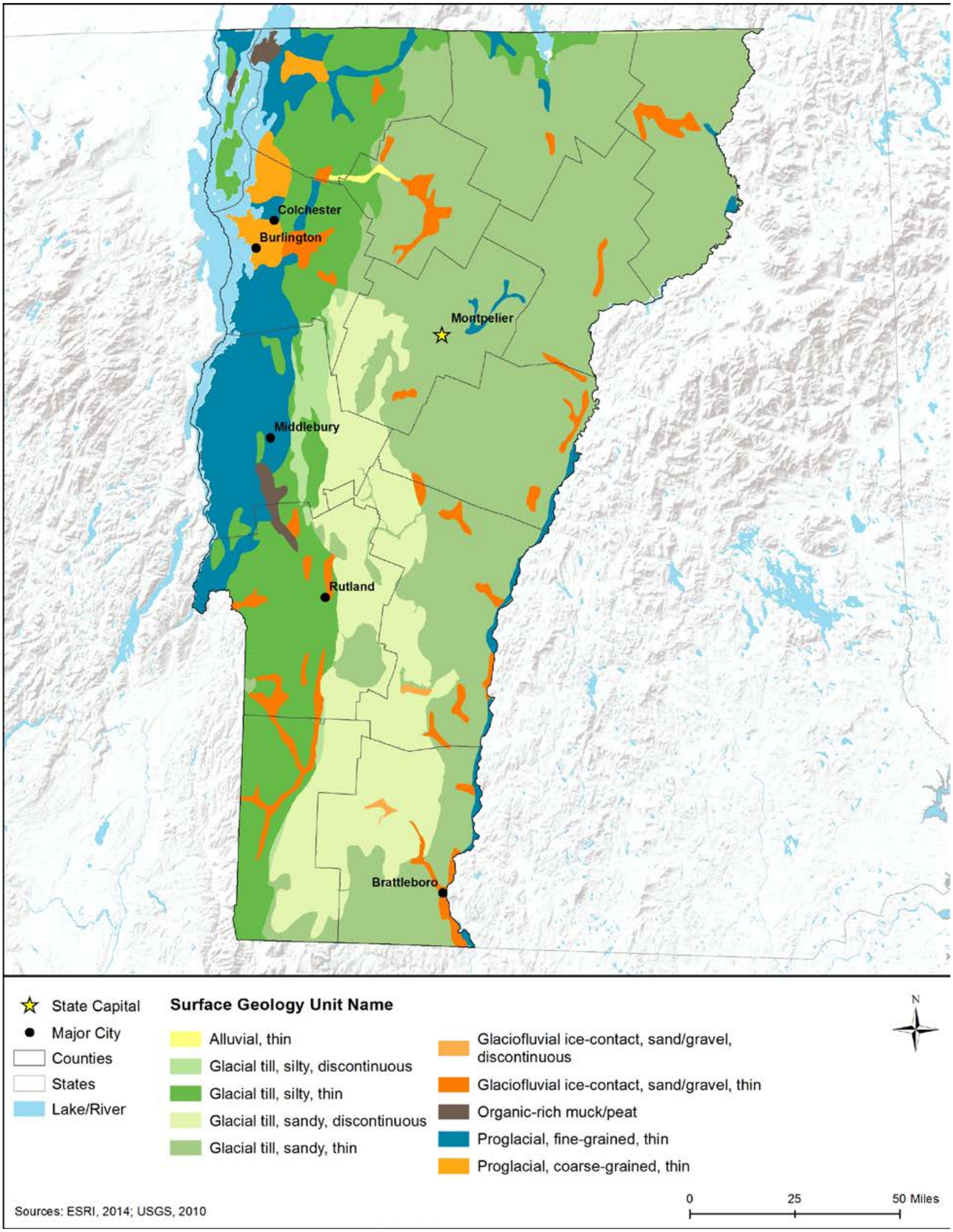

Figure 14.1.3-2: Generalized Surface Geology for Vermont

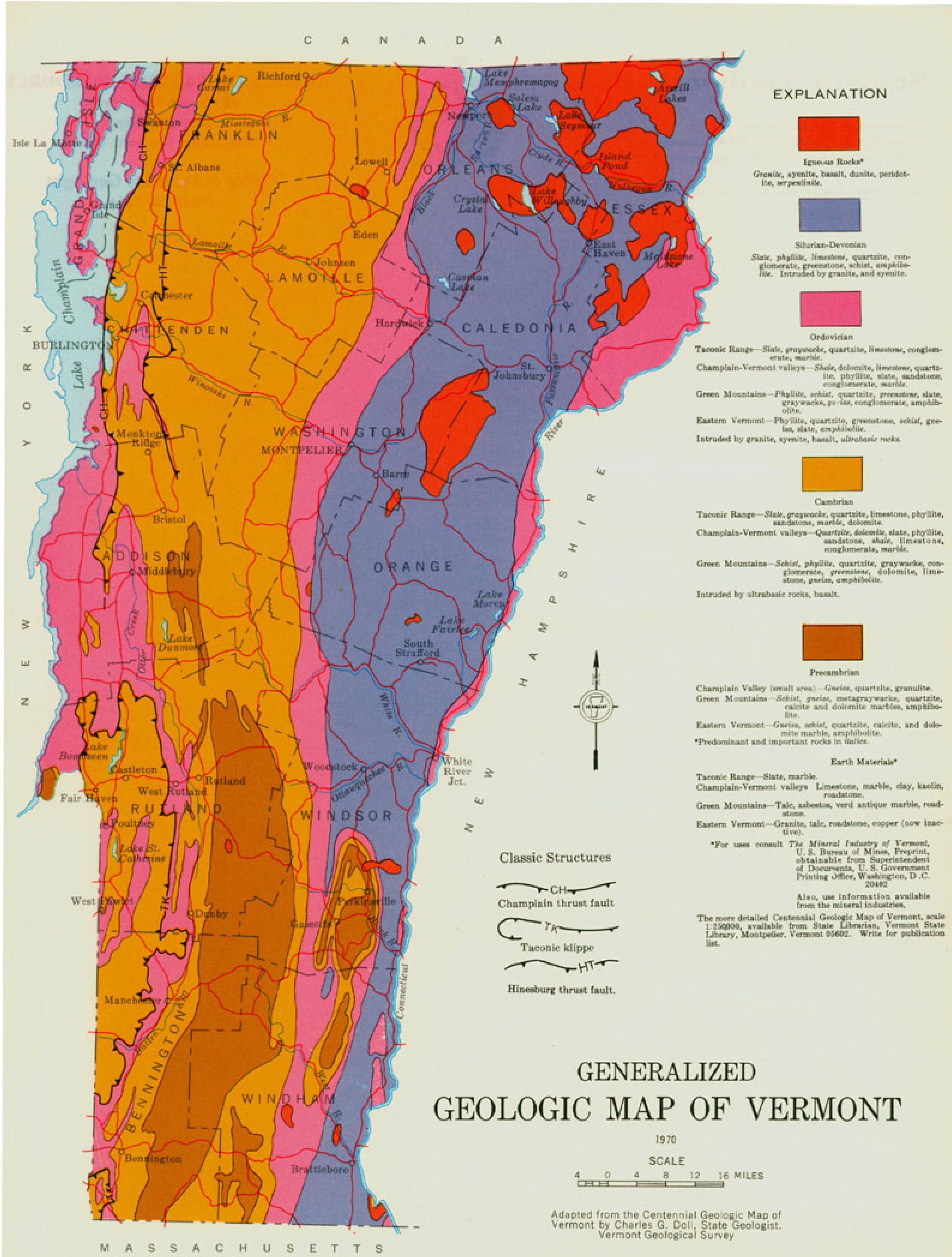

Figure 14.1.3-3: Generalized Bedrock Geology for Vermont

Source: (Vermont Geological Survey, 1970)

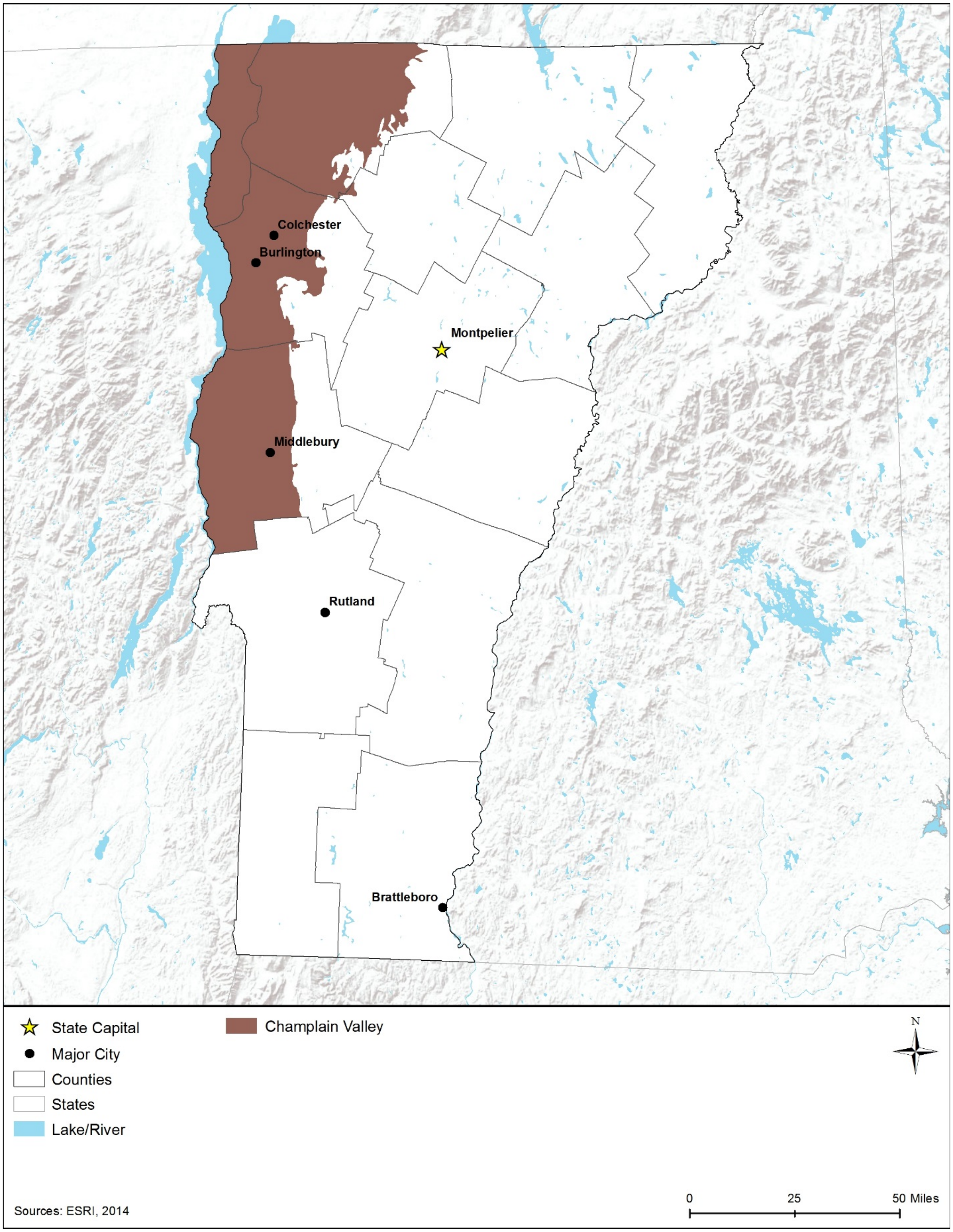

Figure 14.1.3-4: Champlain Valley

14.1.3.8. Geologic Hazards

The three major geologic hazards of concern in Vermont are earthquakes, landslides, and subsidence. Volcanoes do not occur in Vermont and therefore do not present a hazard to the state (U.S. Geological Survey, 2015j). The subsections below summarize current geologic hazards in Vermont.

Earthquakes

Between 1973 and March 2012, there were three earthquakes of a magnitude 2.5 (on the Richter scale) or greater in Vermont, though multiple earthquakes of a comparable magnitude occurred in nearby areas of New York and New Hampshire (U.S. Geological Survey, 2014b). Earthquakes are the result of large masses of rock moving against each other along fractures called faults. Earthquakes occur when landmasses on opposite sides of a fault suddenly slip past each other; the grinding motion of each landmass sends out shock waves. The vibrations travel through the Earth and, if they are strong enough, they can damage manmade structures on the surface (U.S. Geological Survey, 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." 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). Vermont is located far from any convergence boundaries, and is located in the middle of a tectonic plate (Kafka, 2014).

Notable Vermont Earthquakes

The largest earthquake ever recorded in Vermont was a magnitude 4.2 quake that occurred in 1962 (U.S. Geological Survey, 2015k) in the western part of the state. Impacts were felt over 52,000 square kilometers, including in parts of four other states; this earthquake caused minor damage to the Vermont state house (U.S. Geological Survey, 2015l).

depicts the seismic risk throughout Vermont. Areas of greatest seismicity in Vermont are focused in the northwestern portions of the state (U.S. Geological Survey, 2014b). The map indicates levels of horizontal shaking (measured in Peak Ground Acceleration (PGA) 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.[53] (U.S. Geological Survey, 2010)

[53] Post-1985 buildings (in California) have experienced only minor damage with shaking of 60% g. (U.S. Geological Survey, 2010)

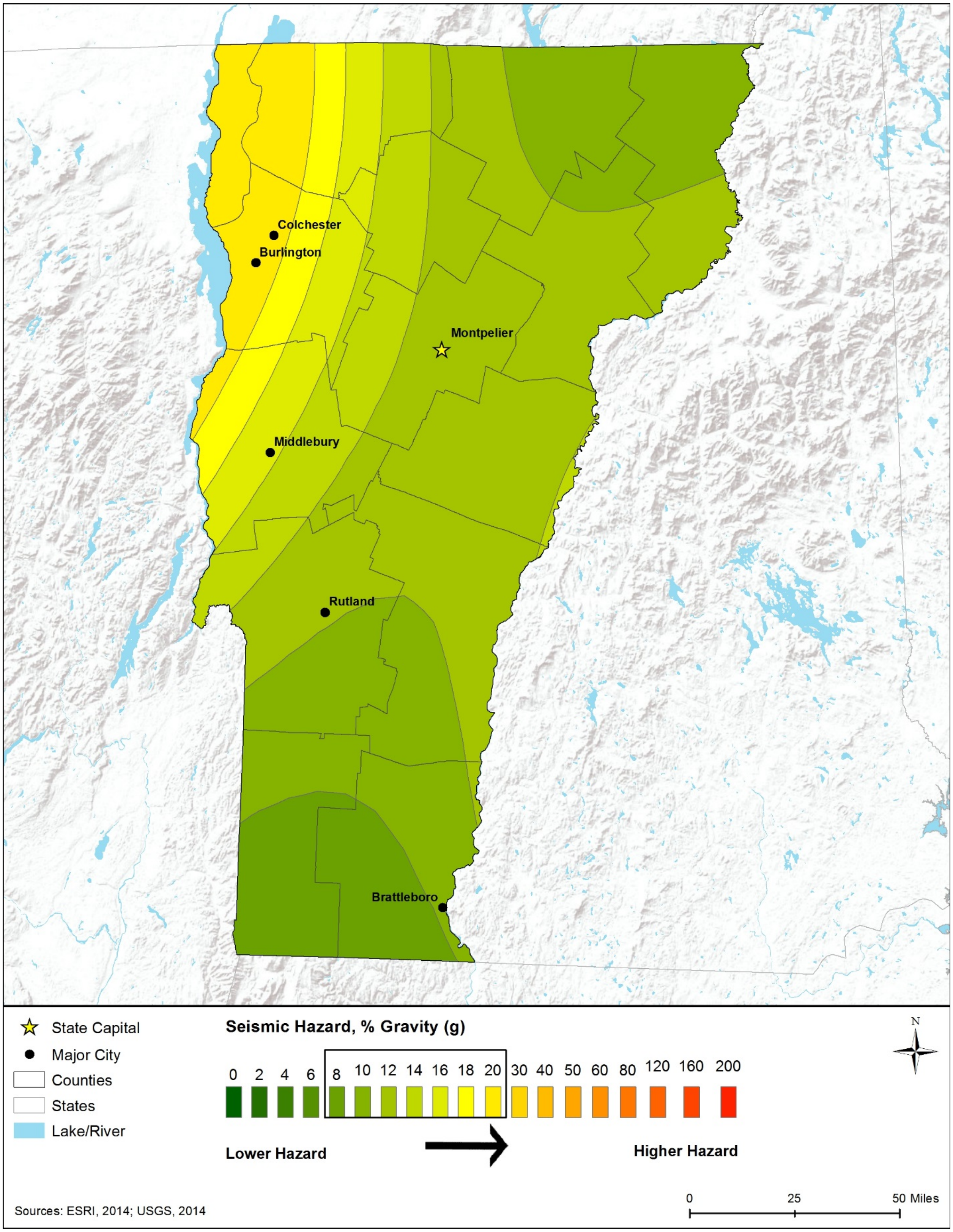

Figure 14.1.3-5: Vermont 2014 Seismic Hazard Map

Landslides

Vermont's geology makes the state highly susceptible to two types of landslide events (Baskerville, Lee, & Ratté, 1993). "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" (U.S. Geological Survey, 2003b). Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale. (U.S. Geological Survey, 2003b)

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

Vermont is at risk to landslides due to its high volume of unconsolidated sediments that lie on its bedrock mountainous surfaces. Vermont is also susceptible to rockslides and debris falls due to the disintegration of bedrock along sloped surfaces; this typically occurs when precipitation enters bedrock joints or faults, and breaks apart the bedrock during repeated freeze-thaw activity. Steep slopes throughout the state are also conducive to landslides in areas containing unconsolidated sediments and broken bedrock. Vermont's climate further contributes to the state's propensity for landslides, as the state generally receives heavy precipitation in both winter and spring, and associated melting as temperatures warm; these elements combined with Vermont's geology make many areas of the state susceptible to landslides. (Baskerville, Lee, & Ratté, 1993)

Rockslide in Westmore, VT

Source: (Eliassen & Springston, 2007)

Human activity has further contributed to slope instability throughout Vermont; "causes of human-induced failures recognized in Vermont include insufficient design of stormwater drainage systems, improper construction and maintenance of logging roads, and inadequate design of slope cuts made for highways" (Baskerville, Lee, & Ratté, 1993). In particular, road construction throughout the state has proven to be a significant cause of landslides, insomuch as that activity creates "slopes that are uneven and contain numerous weak areas" (Eliassen &

Springston, 2007). In an evaluation of more than 3,600 road cuts greater than 5 feet in height, the Vermont Agency of Transportation rated 150 sites having a "high potential for [a] rockfall to occur and reach [the] roadway" (Eliassen & Springston, 2007). In total, 687 study locations were deemed to present at least a minor risk of landslide that could reach a nearby roadway (Eliassen & Springston, 2007). A map of landslide susceptibility throughout Vermont is included in Figure 14.1.3-6.

Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." The main triggers of land subsidence can be aquifer compaction, drainage of organic soils, mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the United States is due to over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If an aquifer is confined by layers of silt or clay, which do not transport groundwater, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the lowering of the land surface elevation, which is permanent (U.S. Geological Survey, 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. (U.S. Geological Survey, 2013b)

The threat of widespread land subsidence in Vermont is minimal due to limited potential or risk from karst topography/sinkholes (Vermont Department of Public Safety, 2013), aquifer compaction (U.S. Geological Survey, 2000), and compression of organic soils (U.S. Geological Survey, 2000). In fact, portions of Vermont may be rising due to isostatic rebound associated with the offloading of the continental glaciers from the Pleistocene Ice Age (Sella, et al., 2007).

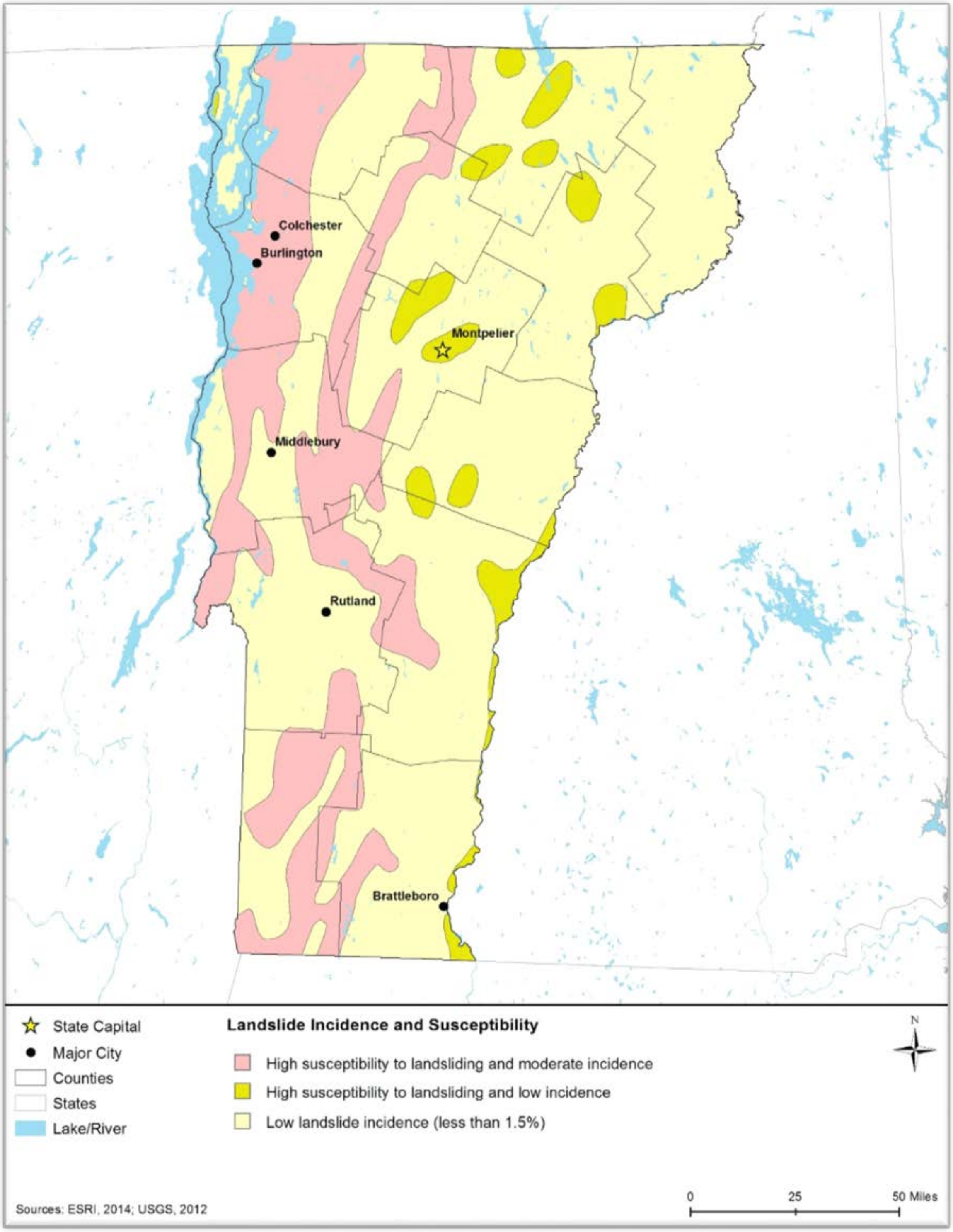

Figure 14.1.3-6: Vermont Landslide Incidence and Susceptibility Hazard Map[54]

[54] Susceptibility hazards not indicated in Figure 14.1.3-7 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

14.1.4. Water Resources

14.1.4.1. Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 14.1.5). These resources can be grouped into watersheds, which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for available water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human health, economic wellbeing, and the maintenance of natural infrastructure and ecological health. (U.S. Geological Survey, 2014c)

14.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C. Table 14.1.4-1 summarizes the major Vermont laws and permitting requirements relevant to the state's water resources.

Table 14.1.4-1: Relevant Vermont Water Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
29 V.S. A. Chapter 11	Vermont Department of Environmental Conservation (DEC)	Projects that encroach on public waters may require a permit. These activities could include constructing bridges, water inlets, cables, docks, walls, and boathouses (DEC, 2015l).
10 V.S.A Chapter 49A	Vermont DEC	Any development, redevelopment, or land clearing within 250 feet of a lake's mean water level, for all lakes greater than 10 acres in size, requires a permit (DEC, 2015m).
10 V.S.A. Chapter 41 Stream Alteration Rule	Vermont DEC	Moving, filling, or excavating 10 or more cubic yards in one year, in any perennial stream, requires a permit (DEC, 2015n).
Water Quality Certification	Vermont DEC	In accordance with Section 401 of the Clean Water Act (CWA), activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from DEC indicating that the proposed activity will not violate water quality standards (DEC, 2015o).
NPDES program	Vermont DEC	Point source discharges of wastewater into surface or groundwater, including the intake and discharge of water for cooling purposes, stormwater discharge, and construction activities that disturb one or more acres require a NPDES permit (DEC, 2012a).

the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated. (U.S. Geological Survey, 2014d)

14.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams. According to the DEC, Vermont has approximately 23,000 miles of rivers and streams and 800 lakes and ponds (DEC, 2015p).

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). Vermont's waters (lakes, rivers, and streams) are divided into 17 major watersheds, or drainage basins (Figure 14.1.4-1). VT Appendix A, Table A-1: Characteristics of Vermont's Watersheds, provides detailed information on the state's major watersheds, as defined by DEC. Visit www.watershedmanagement.vt.gov/planning/htm/pl_basins.htm for information and additional maps about each of the watershed's location, size, and water quality. (DEC, 2015q)

The Lake Memphremagog watershed in Vermont drains approximately 490 square miles in Vermont, or approximately 71 percent of the watershed's total drainage; the remaining 29 percent drainage is located in Quebec, Canada.

- Three major watersheds drain into northern Lake Champlain; they include the Winooski, Lamoille, and Missisquoi. In addition, the Northern Lake Champlain watershed includes all of the other surface waters that drain into the northern portion of Lake Champlain.
- The Southern Lake Champlain watershed includes the Poultney and Mettowee Rivers, along with the Lower Champlain Direct drainages.
- The Otter Creek, Little Otter Creek, and Lewis Creek watershed also includes rivers that drain into southern Lake Champlain.
- The Passumpsic watershed, along with the Upper Connecticut watershed, empties into the northern reach of the Upper Connecticut River, while the White watershed's and the Stevens, Wells, Waits, and Ompompanoosuc watershed's rivers drain into the middle portion of the Upper Connecticut River.
- Watersheds that drain into the southern reach of the Upper Connecticut River include the Ottauquechee and Black watershed, the West, Williams, and Saxtons watershed, and the Deerfield watershed.
- The Battenkill, Walloomsac, and Hoosic river basins in far southwestern Vermont make up the only watershed (Battenkill, Walloomsac, and Hoosic watershed) in Vermont that is part of the larger Hudson River regional watershed. (DEC, 2015q)

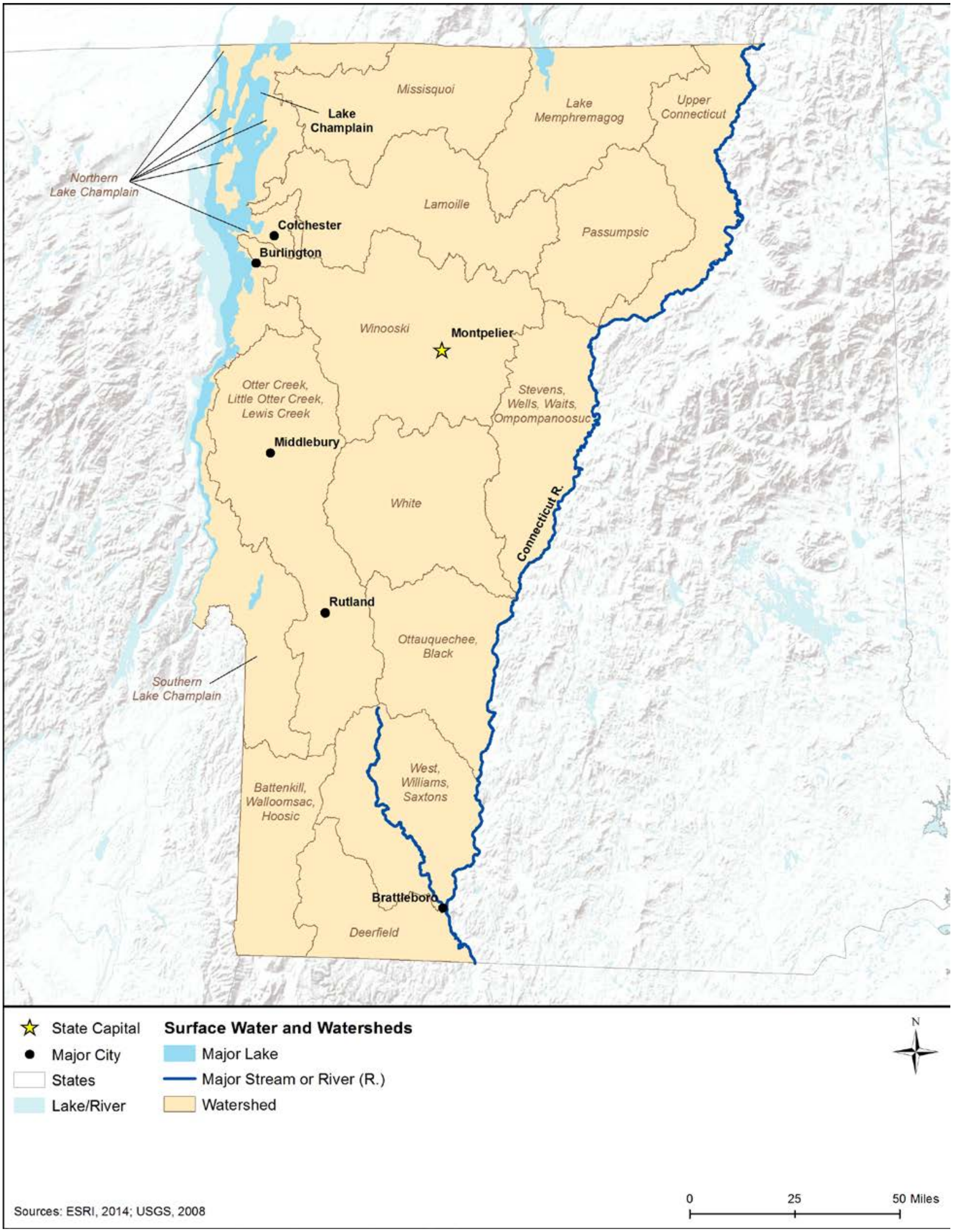

Figure 14.1.4-1: Major Vermont Watersheds and Surface Waterbodies, defined by Vermont DEC

Freshwater

As shown in Figure 14.1.4-1, major rivers in Vermont include the Connecticut River (the largest river in New England), Black River, Lamoille River, Missisquoi River, White River, Winooski River, and Otter Creek. The Connecticut River serves as the border between Vermont and New Hampshire, starting just south of the Canadian border in New Hampshire, and flows south to the Long Island Sound. It drains approximately 4,000 square miles in Vermont. (NH DES, 2008)

Lake Champlain's shores border Vermont and New York. Water flows into Lake Champlain from throughout its drainage basin covering approximately 8,000 square miles, and its outlet is in the Province of Quebec in Canada. Lake Champlain's average depth is 64 feet, and has a maximum depth of 400 feet. Approximately 200,000 people receive their drinking water from the lake, either directly or from public water systems drawing from the lake (Lake Champlain Basin Program, 2015a). Excessive nutrients runoff, particularly phosphorus, is the greatest threat to water quality in Lake Champlain. Vermont DEC and USEPA have been developing an implementation plan to address the high levels of phosphorus, and the plan is expected to be approved by USEPA in September 2015. (DEC, 2015r)

14.1.4.4. Sensitive or Protected Waterbodies

Wild and Scenic Rivers

There are no federally designated National Wild and Scenic Rivers in Vermont (National Wild and Scenic Rivers System, 2015a). However, 46.1 miles (National Wild and Scenic Rivers System, 2015b) of the Missisquoi and Trout Rivers are currently under study as proposed National Wild and Scenic Rivers (VTrans, 2015h).

14.1.4.5. Impaired Waterbodies

Several elements, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, observations of aquatic wildlife communities, and sampling of fish tissue, are used to evaluate water quality. Under Section 303(d) of the Clean Water Act, states are required to assess water quality and report a listing of impaired waters,[55] the causes of impairment, and probable sources. Table 14.1.4-2 summarizes the water quality of Vermont's assessed major waterbodies by category, percent impaired, designated use,[56] cause, and probable sources. Figure 14.1.4-2 shows the Section 303(d) waters in Vermont as of 2014.

As shown in Table 14.1.4-2, various sources affect Vermont's waterbodies, causing impairments. More than half of Vermont's lakes, reservoirs, and ponds are impaired. Designated uses of the impaired lakes include aesthetics, aquatic life, primary and secondary contact recreation, fish consumption, and public water supply. (USEPA, 2015a)

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

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

Table 14.1.4-2: Section 303(d) Impaired Waters of Vermont, 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	83%	7%	Aesthetic, aquatic life, primary and secondary recreation, and fish consumption	pathogens , flow alteration, sediment, mercury, nutrients	Agriculture, atmospheric deposition, dams/impoundments, combined sewer overflows, and urban runoff/storm sewers
Lakes, Reservoirs, and Ponds	100%	87%	Aesthetic, aquatic life, primary and secondary recreation, fish consumption, and public water supply	mercury, polychlorinated biphenyls (PCBs), and nutrients such as phosphorus	atmospheric deposition, inappropriate waste disposal, non-point source, and natural sources

Source: (USEPA, 2015a)
[a] Some waters may be considered for more than one water type
[b] Vermont has not assessed all waterbodies within the state.
[c] Pathogen: a bacterium, virus, or other microorganism that can cause disease (USEPA, 2015b).
[d] Atmospheric deposition: the process by which airborne pollutants settle onto to the earth's surface and pollutants travel from the air into the water through rain and snow ("wet deposition"), falling particles ("dry deposition"), and absorption of the gas form of the pollutants into the water. (USEPA, 2015b)

Vermont DEC has developed a Waterbody Inventory/Priority Waterbodies List (WI/PWL) that characterizes the water quality for all waterbodies in the state (lakes, rivers, streams) (Visit www.vtwaterquality.org/mapp/htm/mp_assessment.htm for results from Vermont's WI/PWLs past sampling and assessment efforts). Based on the state's most recent water quality assessment, major causes of impairment and stress for lakes and ponds include invasive species, fluctuations of water levels, phosphorous, mercury, and pH (acidification).

A statewide consumption advisory for freshwater fish is in place throughout the state due to elevated concentrations of mercury found in fish tissue, as well as PCBs found in fish tissue in Lake Champlain. In Vermont's streams and rivers, sources of impairment and stress come from atmospheric deposition, channel instability and streambank erosion (including subsequent loss of riparian vegetation), urban land and agricultural runoff and changes in hydrology, and hydroelectric and snowmaking facilities. These sources result in increased sediments, alteration of habitat, change in temperature and flow, turbidity, and excess nutrients, pathogens, and metals. (DEC, 2014a)

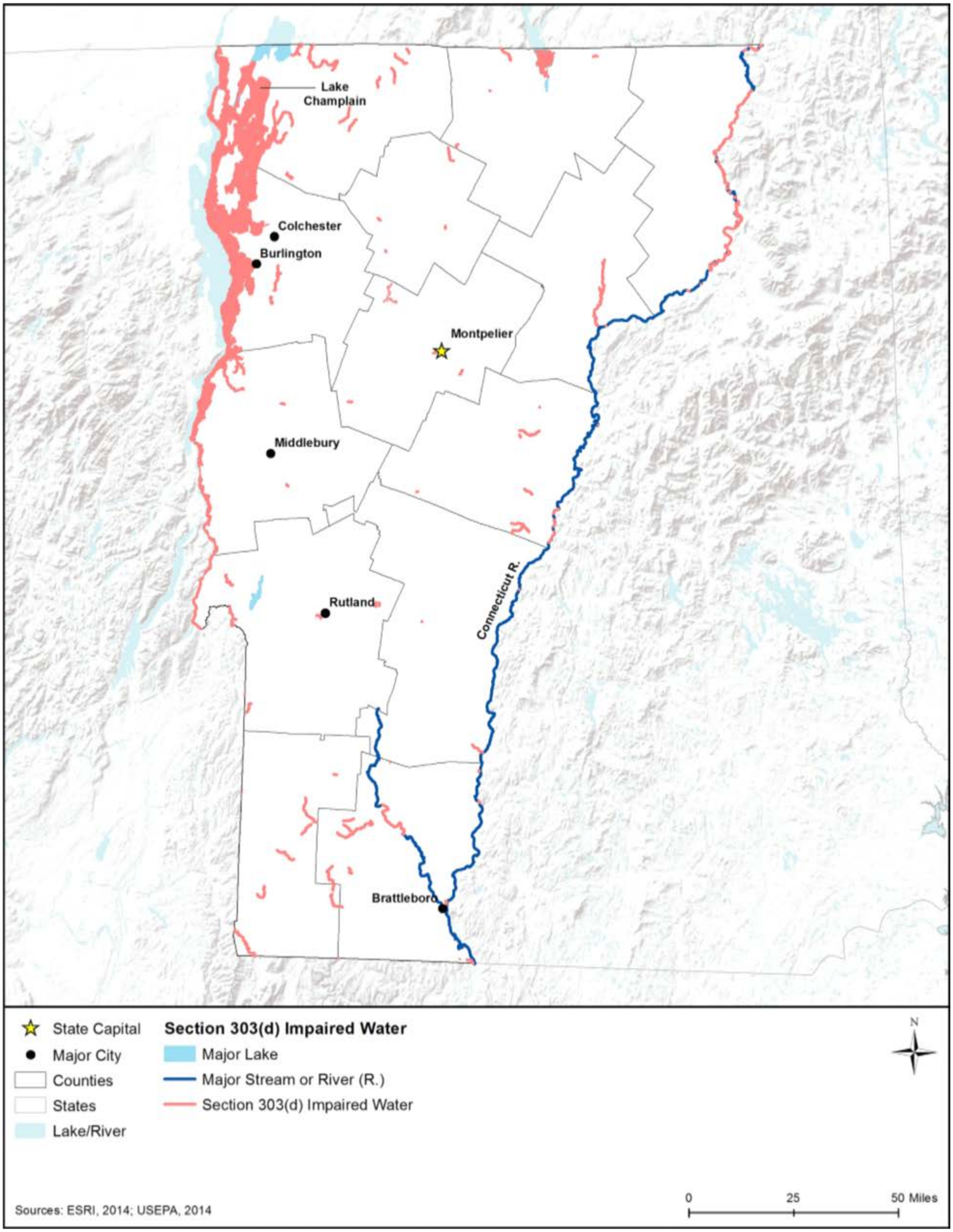

Figure 14.1.4-2: Section 303(d) Impaired Waters of Vermont, 2012

14.1.4.6. Floodplains

Floodplains are lowlands along inland or coastal waters, including flood-prone areas of offshore islands. The Federal Emergency Management Agency (FEMA) defines a floodplain or flood-prone area as "any land area susceptible to being inundated by water from any source" (44 Code of Federal Regulations [CFR] 59.1) (Federal Emergency Management Agency, 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 (Federal Emergency Management Agency, 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. (Federal Emergency Management Agency, 2014a)

The primary type of floodplains in Vermont are riverine and lake floodplains.

- **Riverine and lake floodplains** occur along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. In mountainous areas, floodwaters can build and recede quickly, with fast moving and deep water. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters. Whereas, flatter floodplains may remain inundated for days or weeks, covered by slow-moving and shallow water. (Federal Emergency Management Agency, 2014b)
- Flooding is the most common recurring hazard in the state in terms of both intensity and severity of flood events increasing in recent years. There are several causes of flooding in the state, including flooding from rain events and snowmelt, flash flooding, urban flooding, and ice jams. (Vermont Emergency Management, 2013)

Although some areas, such as floodplains, are more prone to flooding than others, no area in the state is exempt from flood hazards. Those municipalities with the greatest vulnerability to flooding include Montpelier, Barre, Bennington, Rutland, and Ludlow. (Vermont Emergency Management, 2013)

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. FEMA provides floodplain management assistance, including mapping of 100-year floodplain limits, to approximately 300 communities in Vermont through the National Flood Insurance Program (NFIP) (Federal Emergency Management Agency, 2014c). Established to reduce the economic and social cost of flood damage, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (Federal Emergency Management Agency, 2015b). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, Vermont had three communities participating in the CRS (Federal Emergency Management Agency, 2014d).[57]

2011 Flooding

In 2011, President Obama issued four disaster declarations. Three were issued in April and May, after heavy rains on a deep snowpack in late March and early April resulted in riverine flooding and Lake Champlain going over its 500-year flood elevation. Then in August, Tropical Storm Irene dropped up to 11 inches of rain in parts of the state. It resulted in catastrophic flooding throughout the state, catastrophic property damage, and loss of life. (Vermont Emergency Management, 2013)

Source: (National Oceanic and Atmospheric Administration, 2015a)

14.1.4.7. Groundwater

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

[57] A list of the three 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)

Vermont's principal aquifers[58] consist of carbonate-rock[59] and sand and gravel aquifers of alluvial and glacial origin.[60] There are no sole source aquifers within Vermont (USEPA, 2014a). Approximately half of Vermont's population depends on groundwater for their drinking water supply (Cotton & Butterfield, 1987). The quantity and quality of the state's groundwater supply varies, but is overall suitable for most uses. In addition to water supply, groundwater is utilized for agriculture, commercial and manufacturing uses, and in supporting habitat for aquatic life. (DEC, 2015s)

Table 14.1.4-3 provides details on aquifer characteristics in the state; Figure 14.1.4-3 shows Vermont's principal aquifers.

Table 14.1.4-3: Description of Vermont's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
New York and New England Carbonate-rock aquifers Consolidated bedrock of limestone, dolomite, and marble and are generally soluble.	Occurs in western Vermont	Due to high calcium and magnesium concentrations found in carbonate-rock aquifers, water ranges from moderately hard to very hard. The water can also have dissolved solid exceedances[61]. Overall, the water is suitable for most uses. (U.S. Geological Survey, 1995)
Aquifers of Alluvial and Glacial Origin These aquifers consist mainly of the sand, gravel, and bedrock eroded by the glaciers.	Throughout the state	Suitable for most uses. Vulnerable to contamination because of the unconfined conditions of the aquifers and high water table (typically less than 30 feet beneath ground surface). (Cotton & Butterfield, 1987)

Source: (Cotton & Butterfield, 1987) (U.S. Geological Survey, 1995)

[58] In this PEIS, the term principal aquifer refers to the USGS definition ("A regionally extensive aquifer or aquifer system that has the potential to be used as a source of potable water.") for nationwide consistency (U.S. Geological Survey, 2003c).
[59] Carbonate-rock aquifers typically consist of limestone with highly variable water-yielding properties (some yield almost no water and others are highly productive aquifers) (Olcott 1995a).
[60] Sand and gravel aquifers of alluvial (sand, silt, or gravel materials left by river waters) and glacial origin are highly productive aquifers in the northern part of the country, consisting of mostly sand and gravel deposits formed by melting glaciers (U.S. Geological Survey, 2015m).
[61] Exceedances for total dissolved solids or other high concentrations of minerals that exceed USEPA or state standards.

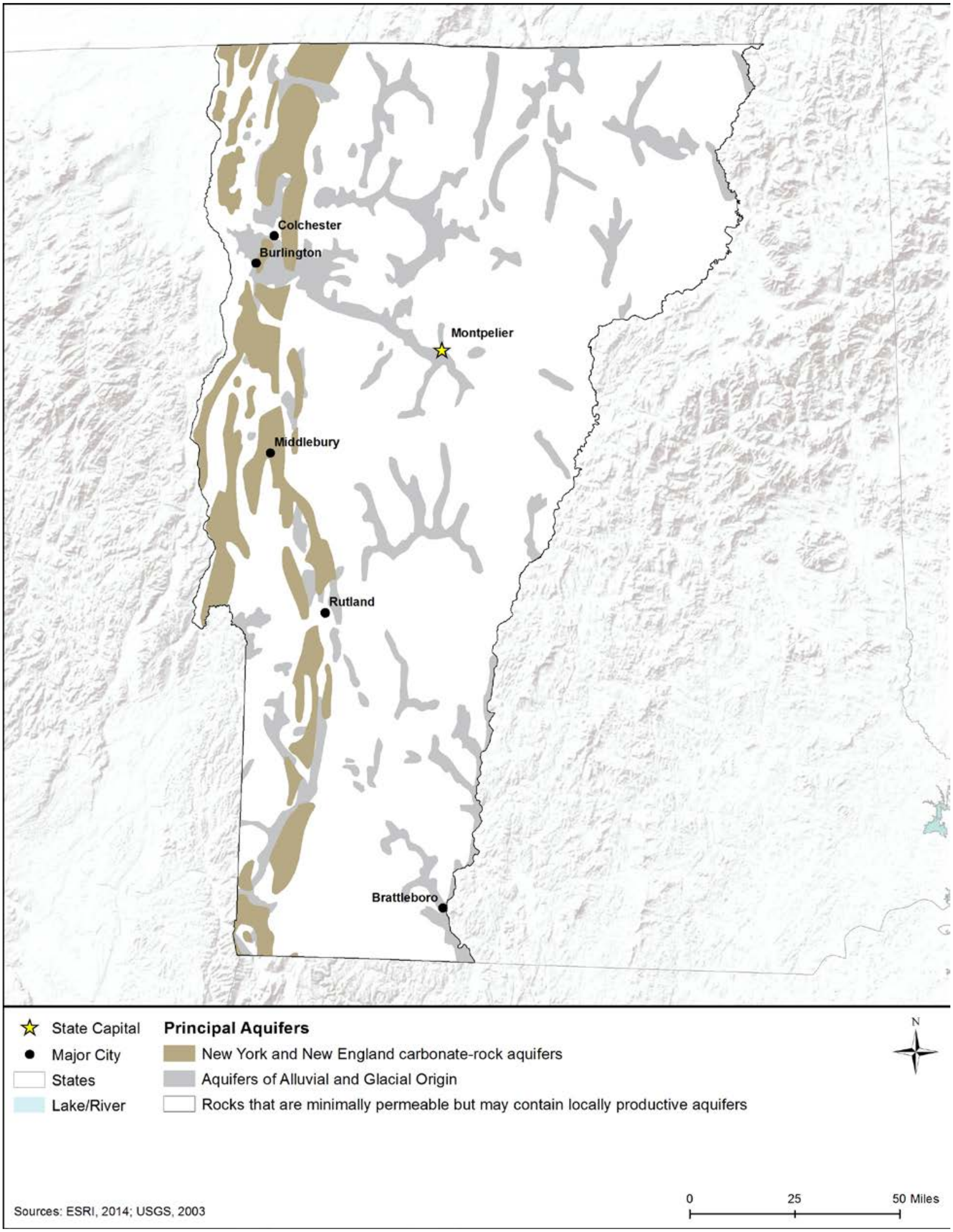

Figure 14.1.4-3: Principal Aquifers of Vermont

14.1.5. Wetlands

14.1.5.1. Definition of the Resource

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

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

14.1.5.2. Specific Regulatory Considerations

Table 14.1.5-1 summarizes the major Vermont state laws and permitting requirements relevant to the state's wetlands.

Table 14.1.5-1: Relevant Vermont Wetlands Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Vermont Wetland Rules (2010)	Vermont Department of Environmental Conservation (DEC)	Requires permit for any activity in a Class I or Class II wetland or its associated buffer zone (generally 100 foot for Class I and 50 foot for Class II).
Water Quality Certification	DEC	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 DEC indicating that the proposed activity will not violate water quality standards. (DEC, 2015t)

14.1.5.3. Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard (WCS) that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined in (Cowardin, L. M.; Carter, V.; Golet, F. C.; LaRoe, E. T., 1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats. (USFWS, 2015b)

- 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, L. M.; Carter, V.; Golet, F. C.; LaRoe, E. T., 1979).

Vermont has approximately 300,000 acres of wetlands (DEC, 2015u). In Vermont, the two main types of wetlands are palustrine (freshwater) wetlands found along river and lake floodplains across the state, and lacustrine[62] wetlands found near lakes and ponds. Table 14.1.5-2 uses 2014 NWI data to characterize and map Vermont wetlands on a broad-scale. The data are not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known. The map codes and colorings in Table 14.1.5-2 correspond to the wetland types in Figure 14.1.5-1.

Palustrine Wetlands

In Vermont, the dominant wetland type is forested wetlands (PFO) (approximately 120,000 acres). Broad-leaf deciduous wetlands comprise the majority of forested wetlands (58,600 acres), which includes all swamps dominated by broad-leaved deciduous trees; along with mixed swamp types that are dominated by broad-leaved deciduous trees but also have some conifers. Mineral and organic-soil swamps and floodplain forests are found along rivers. (Sorenson, et al., 2004)

More than 35 percent of Vermont's original wetlands have been lost; primarily from industrial, commercial, and residential development (DEC, 2014b). In 2010, the Vermont Wetland Rules were passed to provide additional protection to "significant wetlands," pursuant to 10 V.S.A. Section 6025(d)(5). Significant wetlands are those identified by the Nongame and Natural Heritage Program of the Vermont Fish and Wildlife has being high quality examples of one of Vermont's recognized natural community types. These example community types include:

[62] Lacustrine wetlands are those associated with lakes or shallow reservoir basins.

Table 14.1.5-2: Vermont 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, with larger areas on the western and northeastern regions.	181,083
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.		
Palustrine emergent wetlands	PEM	PEM wetlands have erect, rooted, green-stemmed, annual, water-loving plants, excluding mosses and lichens present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens,[c] prairie potholes, and sloughs.[d]	Throughout the state, with larger areas in western and northeastern regions.	48,469
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	14,786
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Other Palustrine wetland	Misc. Types	Farmed wetland, saline seep,[e] and other miscellaneous wetlands are included in this group.	Throughout the state	1,200
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	465
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.	Mainly along the shores of Lake Champlain	22,522

Source: (Cowardin, L. M.; Carter, V.; Golet, F. C.; LaRoe, E. T., 1979), (USFWS, 2015d), (Federal Geographic Data Committee, 2013)

[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin et al. (1979), some data has been revised based on the latest scientific advances. The USFWS uses these standards as the minimum guidelines for wetlands mapping efforts. (Federal Geographic Data Committee, 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, 2015c)

[c] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water. (USEPA, 2016)

[d] Slough: "Swamp or shallow lake system, usually a backwater to a larger body of water." (National Oceanic and Atmospheric Administration, 2016)

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

common wetland deep bulrush marsh, cattail marsh, northern white cedar swamp, red maple black ash seepage swamp, and spruce fir tamarack swamp, along with more rare wetland types such as red maple black gum swamp, alpine peatland, dwarf shrub bog, and rich fen (Vermont Natural Resources Board, 2010). These rules outline 10 functions and values that comprise significant wetlands, and establish a three-tier system of classification. Class I and Class II wetlands are considered significant, and they along with their buffer zones (100 feet for Class I and 50 feet for Class II) are protected under the Vermont Wetland Rules. Class III wetlands under the Vermont Wetland Rules are not considered significant, and are therefore not protected under those rules. Permits in these areas are only issued if DEC determines that the activity or use will not have adverse impacts on the protected function, unless the impacts can be mitigated. (DEC, 2014b)

Lacustrine Wetlands

Lacustrine wetlands in Vermont are mostly found near the shore of Lake Champlain. Lake Champlain's wetlands provide habitat to both fish and wildlife, as well as migratory habitat for wetland birds and waterfowl during their annual migration along the Atlantic Flyway. These wetlands also control flooding and erosion, and stabilize the shoreline. They also protect the lake's water quality by filtering pollutants, sediments, and nutrients from runoff into Lake Champlain. (Lake Champlain Basin Program, 2015b)

Riverine Wetlands

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

14.1.5.4. Wetlands of Special Concern or Value

In addition to protections under the national CWA, Vermont's Wetland Rules consider certain wetland communities as significant. These include bogs and vernal pools.

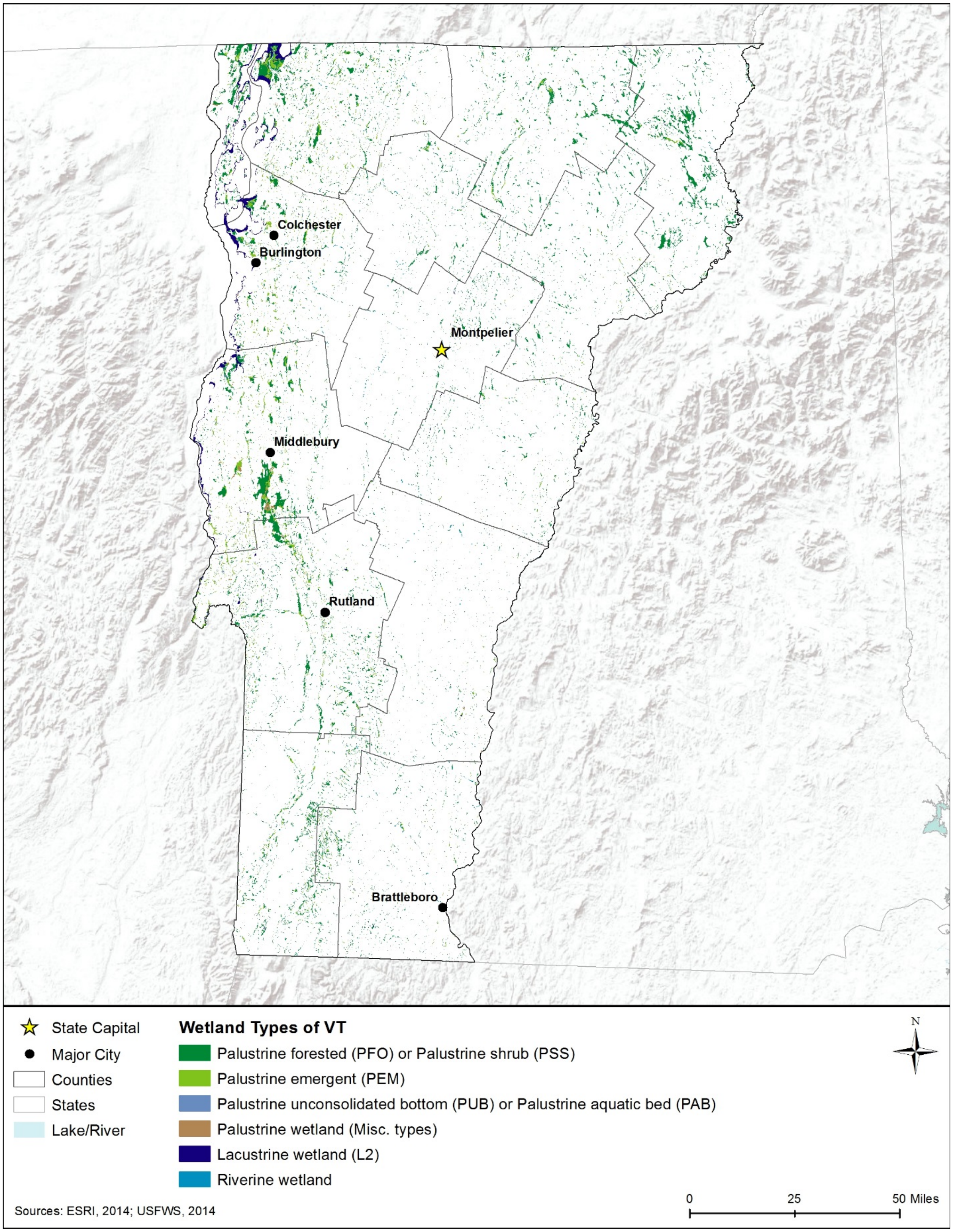

Figure 14.1.5-1: Wetlands by Type in Vermont, 2014

Bogs

Bogs are palustrine wetlands that the state has classified as special and unique, and are therefore significant. In Vermont, bogs depend on the abundance of water, and are only found in depressions where water has collected and drainage is slow or stopped. Typical vegetation found in bogs include sedge (*Cyperaceae*), sphagnum moss (*Bryophyta*), Labrador tea (*Ledum groenlandicum*), leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda polifolia*), blueberry (Cyanococcus), and cranberry (*Oxycoccus*). Animals that may be observed in bogs in Vermont include the four-toed salamander (*Hemidactylium scutatum*), painted turtle (*Chrysemys picta*), and small rodents including the southern bog lemming (*Synaptomys cooperi*). Although more infrequent, siting of birds, such as the Lincoln's sparrow (*Melospiza lincolnii*), red-capped palm warbler (*Setophaga palmarum*), yellow-bellied flycatcher (*Empidonax flaviventris*), and rusty blackbird (*Euphagus carolinus*) sometimes occur. (Vermont Fish and Wildlife Department, 2015a)

Figure 14.1.5-2: Vermont Bog

Source: (DEC, 2014b)

Vernal Pools

Vernal pools are palustrine wetlands that the state has classified as significant. They are small, temporary wetlands that fill from rain, snowmelt, or groundwater, and usually become dry by summer as the water evaporates. They support many amphibians and insect species' habitats (Kellogg, 2015). Common indicator species[63] in vernal pools in Vermont include the spotted salamander (*Ambystoma maculatum*), blue-spotted salamander (*Ambystoma laterale*), Jefferson salamander (*Ambystoma jeffersonianum*), marbled salamander (*Ambystoma opacum*), wood frog (*Lithobates sylvaticus*), and fairy shrimp (*Anostraca*) (Natural Resources Conservation Service, 2010). The DEC and the Vermont Wildlife Diversity Program have been collaboratively working to develop methods for the classification and bioassessment[64] of vernal pools (DEC, 2015v).

Other important wetland sites in Vermont include:

- The Missisquoi National Wildlife Refuge (NWR) on the eastern shore of Lake Champlain near the border with Canada. The 6,729-acre NWR is mostly wetland habitat, and includes the 900-acre Maquam bog. This refuge provides habitat for more than 200 species of birds,

[63] Indicator Species: Wetland plants that are designated a status based on their preference for occurrence in an upland or wetland. Indicator status is used in wetland determinations and delineations. (U.S. Department of Commerce, 2013a)

[64] Bioassessment: An evaluation to determine if a waterbody meets its designated aquatic life use, via the utilization of surveys and other direct measurements of resident biological organisms such as fish, plants, and macroinvertebrates. (USEPA, 2013a)

and also supports the fall migration of approximately 25,000 migrating ducks. (USFWS, 2014a) Read more about the NWR in Land Use, Section 3.3.7.

- Wildlife Management Areas are designed to protect fish, wildlife, and their habitat, and comprise 118,000 acres in Vermont, some of which include wetlands. To learn more about state Wildlife Management Areas, visit www.anr.state.vt.us/fwd/WmaLocator.aspx.
- National Natural Landmarks range in size from 10 acres to nearly 4,000 acres, and are owned by Vermont Agency of Natural Resource, The Nature Conservancy, universities, municipalities, and other conservation organizations and individuals (National Park Service, 2015b). Visit www.nature.nps.gov/nnl/state.cfm?State=VT to learn more about Vermont's National Natural Landmarks.
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state, including NRCS, and easements managed by natural resource conservation groups such as state land trusts, state agencies, the Vermont Housing and Conservation Board, and The Nature Conservancy. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), NRCS holds more than 7,600 acres in conservation easements in Vermont. (National Conservation Easement Database, 2015)

For more information on Vermont's wildlife management areas, National Natural Landmarks, conservation programs, and easements, see Section 14.1.7, Land Use, Recreation, and Airspace, and Section 14.1.8, Visual Resources.

14.1.6. Biological Resources

14.1.6.1. Definition of the Resource

This section describes the biological resources of Vermont. Biological resources include terrestrial[65] vegetation, wildlife, fisheries and aquatic habitats,[66] and threatened[67] and endangered[68] species as well as species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Vermont supports diverse biological resources given the landscape of mountains, valleys, wetlands[69], lakes, and rivers. Each of these topics is discussed in more detail below.

[65] Terrestrial: "Pertaining to the land." (USEPA, 2015c)
[66] Habitat: "The environment in which an organism or population of plants or animals lives; the normal kind of location inhabited by a plant or animal." (USEPA, 2015c)
[67] 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)).
[68] 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)).
[69] Wetlands: "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." (USEPA, 2015c)

14.1.6.2. Specific Regulatory Considerations

The federal laws relevant to the protection and management of biological resources in Vermont are summarized in detail in Appendix C. Table 14.1.6-1 summarizes major federal and state laws relevant to Vermont's biological resources.

Table 14.1.6-1: Relevant Vermont Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Vermont Plant Quarantine Rule (Vermont Agency of Agriculture, Food, and Markets [VAAFM] Quarantine #3 – Noxious Weeds)	Vermont Agency of Agriculture, Farm, and Markets [VAAFM]	Establishes a program for the regulation of noxious weeds, quarantine of noxious weeds, and creation of statewide species list.
Aquatic Nuisance Control (10 Vermont Statutes Annotated (V.S.A.) § 1451-1460)	Vermont Agency of Natural Resources	Establishes a program for aquatic nuisance control and directs the Agency of Natural Resources to prevent the infestation and proliferation of invasive[70] species.
Nongame Wildlife Species (10A V.S.A. § 25)	Vermont Fish and Wildlife Department	Establishes a plan for the management of nongame wildlife species, including monitoring and management of species, habitat, and natural communities.
Protection of Endangered Species (10 V.S.A. § 5401-5410)	Vermont Agency of Natural Resources	Provides protection for the taking, possessing, or transportation of wildlife or plants that are members of an endangered or threatened species.

14.1.6.3. Terrestrial Vegetation

The distribution of flora[71] within Vermont is a function of the characteristic geology,[72] soils, climate, and water of a given geographic area and correlates 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; they depict a general area with similar ecosystem types, functions, and qualities. (National Wildlife Federation, 2015) (U.S. Department of Agriculture, 2015a) (World Wildlife Fund, 2015)

Ecoregion boundaries often coincide with physiographic[74] regions of an area. The ecoregions mapped by the USEPA are the most commonly referenced, although individual states and

[70] Invasive: "These are species that are imported from their original ecosystem. They can out-compete native species as the invaders often do not have predators or other factors to keep them in check." (USEPA, 2015c)
[71] The plants of a particular region, habitat, or geological period.
[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 groundwater 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, 2015c)
[74] Physiographic: "The natural, physical form of the landscape." (USEPA, 2015c)

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 United States 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 the District for USEPA's Level III ecoregion. (Bryce, et al., 2010)

As shown in Figure 14.1.6-1, the USEPA lists three Level III ecoregions in Vermont. These ecoregions divide the state based approximately on the Lake Champlain valley in the northwestern portion of the state and the more mountainous and hilly regions in the rest of the state, as well as a small portion of extreme southeast Vermont. Plant communities range from floodplain forests and woodlands in the northwest and in lower elevation areas, to hardwood and spruce-fir forests in the higher elevations of the central and eastern portions of the state, with swamps and bogs occurring throughout the state but primarily in the central and northern regions. Table 14.1.6-2 provides a summary of the general abiotic[75] characteristics, vegetative communities, and the typical vegetation found within both Vermont ecoregions.

In addition to the USEPA ecoregions, geographic regions have been included in Table and will be used in describing Vermont's biological resources in the following sections. Vermont has been divided into three regions: Green Mountains, Southern Vermont, and Champlain Valley. The Champlain Valley includes Lake Champlain along the state's western border up to the base of the Green Mountains. The Green Mountain geographic area includes the Green Mountains and Piedmont regions of the northeast and east-central portions of the state. The Southern Vermont geographic region includes the entire southern portion of the state, including the Taconic Mountains and Vermont Valley, as well as the southernmost Green Mountains and Piedmont region.

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

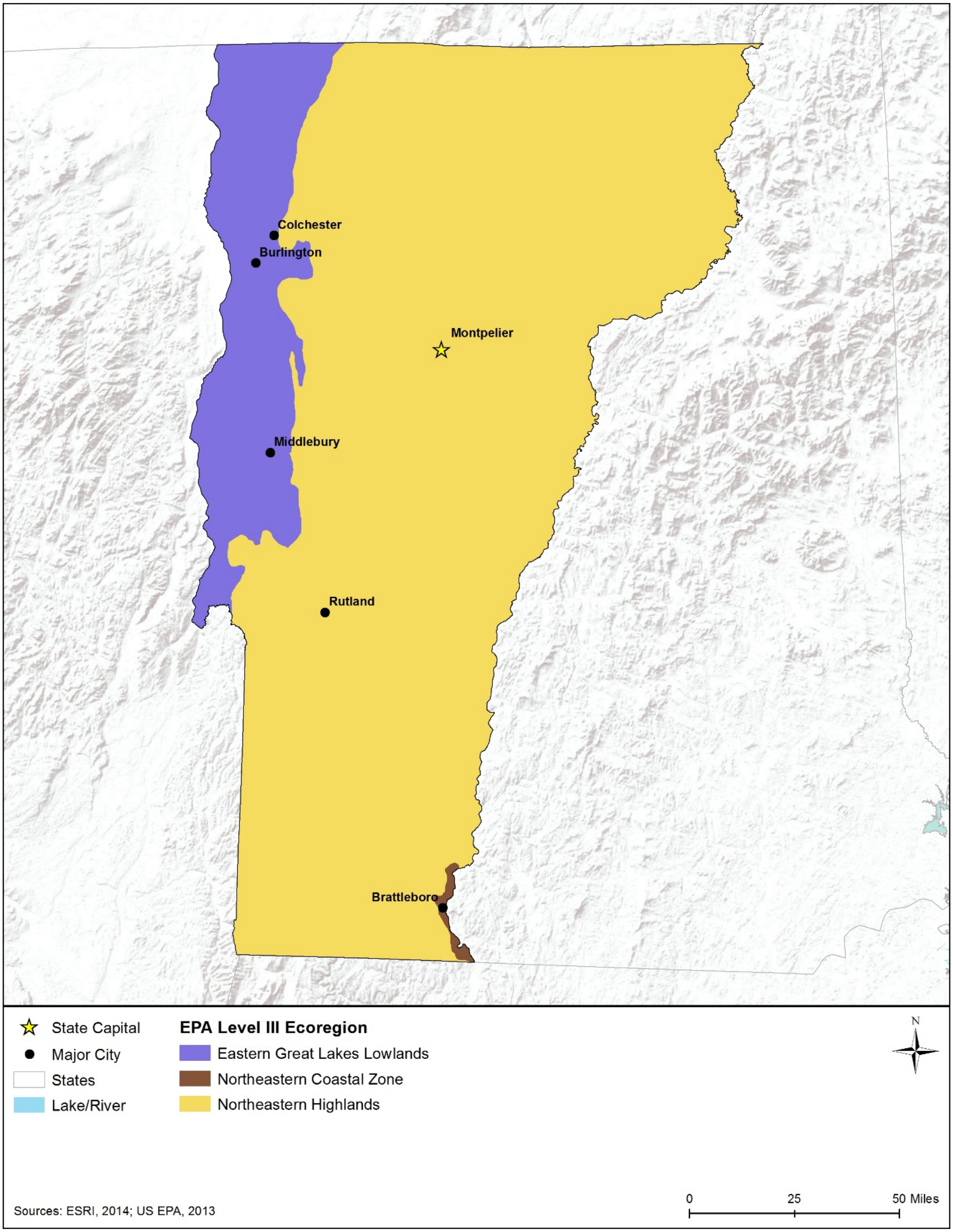

Figure 14.1.6-1: USEPA Level III Ecoregions of Vermont

Table 14.1.6-2: USEPA Level III Ecoregions of Vermont

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
Geographic Regions: Green Mountains and Southern Vermont [a]				
58	Northeastern Highlands	Characterized by hills and mountains, mostly forested land cover, nutrient-poor frigid soils, and numerous high-gradient streams and glacial [b] lakes.	Northern hardwood forest, Northern hardwoods/spruce forest, Northeastern spruce-fir forest	**Hardwood Trees** – Maples (*Acer* spp.), American beech (*Fagus grandifolia*), Birches (*Betula* spp.), Oaks (*Quercus* spp.), Shagbark hickory (*Carya ovata*) **Conifer Trees** – Red spruce (*Picea rubens*), Black spruce (*Picea mariana*), Balsam fir (*Abies balsamea*), Eastern hemlock (*Tsuga canadensis*), White pine (*Pinus strobus*) **Shrubs** - Blueberry (*Vaccinium* spp.), Shadbush (*Amelanchier* sp.), Witch hazel (*Hamamelis virginiana*), Mountain maple (*Acer spicatum*)
Geographic Region: Southern Vermont				
59	Northeastern Coastal Zone	Characterized by irregular and hilly plains. Similar to the Northeastern Highlands ecoregion with glacial lakes and relatively nutrient-poor soils.	Appalachian oak forest, Appalachian oak-hickory forest, Northeastern oak-pine forest	Hardwood Trees – Oaks (*Quercus* spp.), Silver maple (*Acer saccharinum*), Cottonwood (*Populus deltoides*), Shagbark hickory (*Carya ovata*) Conifer Trees – White pine (*Pinus strobus*), Eastern hemlock (*Tsuga canadensis*) Shrubs - Blueberry, Shadbush, Witch hazel
Geographic Region: Champlain Valley				
83	Eastern Great Lakes Lowlands	Irregular plains bordered by hills with a history of glacial activity. Champlain Lowlands sub-ecoregion separate Adirondack Mountains from the Green Mountains. Moderate climate due to low elevation and Lake Champlain. Glacial deposits result in distinctive plant communities in some areas.	Floodplain forest, Northern hardwood forest, Dry oak forest, Valley clayplain forest, Pine/oak heath sandplain forest, Eastern redcedar woodland	**Hardwood Trees** - Maples, Green ash (*Fraxinus pennsylvanica*), Swamp Oaks (*Quercus* spp.), American beech, Yellow birch (*Betula alleghaniensis*), Shagbark hickory, Hophornbeam (*Ostrya virginiana)* **Conifer Trees** – Eastern hemlock, White Pine, Pitch pine (*Pinus rigida*), Northern white cedar (*Tsuga occidentalis*), Red pine (*Pinus resinosa*), Eastern redcedar (*Juniperus virginiana*) **Shrubs** – Black huckleberry (*Gaylussacia baccata*), Blueberry, Choke cherry (*Prunus virginiana*), Shadbush, Witch hazel

Sources: (Bryce, et al., 2010) (USEPA, 2015c)

[a] The Green Mountain geographic area includes the Green Mountains and Piedmont regions of the northeast and east-central portions of the state. The Southern Vermont geographic region includes the entire southern portion of the state, including the Taconic Mountains and Vermont Valley, as well as the southernmost Green Mountains and Piedmont region.

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

Communities of Concern

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

The Vermont Fish and Wildlife Department (VFWD) Nongame and Natural Heritage Program (NNHP) statewide inventory includes lists of all types of natural communities known to occur, or that have historically occurred, in the state. Historical occurrences are important for assessing previously undocumented occurrences or re-occurrences of previously documented species. Each natural community is assigned a rank based on its rarity and vulnerability. As with most state heritage programs, the NNHP ranking system assesses rarity using a state rank (S1, S2, S3, S4, S5) that indicates its rarity within Vermont. Communities ranked as an S1 by the NNHP are of the greatest concern. This rank is typically based on the number of known examples, total area occupied, and the degree of threat to the community. In Vermont, inventories for significant natural communities have taken place at watershed[76] and county levels, statewide inventories have been conducted for specific natural community types, and only a few towns have completed such inventories (Austin, et al., 2013). The VFWD and the Vermont Department of Forests, Parks and Recreation have a program in place to map natural communities on all state lands. As new data become available, ranks are revised as necessary to reflect the most current information (Austin, et al., 2013).

Twelve vegetative communities are ranked as S1 communities[77] in Vermont. These communities occur throughout the state, primarily in the Lake Champlain region and along the Green Mountains. Vermont Appendix B, Table B-1 provides a description of the S1 communities of conservation concern in Vermont along with their distribution, abundance, and the associated USEPA Level III ecoregions and geographic regions.

Two endangered plants are located in Vermont. Section 14.1.6.6, Threatened and Endangered Species, identifies these protected species.

Nuisance and Invasive Plants

Nuisance and invasive plants are a broad category that includes a large number of undesirable plant species. Direct impacts to nuisance and invasive plants may be viewed as beneficial to the environment, but often such impacts result in the inadvertent and unintended spread and dispersal of these species. Construction sites in particular provide colonizing opportunities for

[76] Watershed: "The land area that catches rain or snow and drains it into a local waterbody (such as a river, stream, lake, marsh, or aquifer) and affects its flow, and the local water level." (USEPA, 2015c)

[77] S1 – Very rare in the state, generally with fewer than five high quality occurrences (Vermont Fish and Wildlife Department, 2012a). S2 – Rare in the state, occurring at a small number of sites or occupying a small total area in the state (Vermont Fish and Wildlife Department, 2012a).

nuisance and invasive species, and long-term maintenance activities can perpetuate a disturbance regime that facilitates a continued dispersal mechanism for the spread of these species.

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

Noxious weeds are a threat to Vermont's working forests, agricultural lands, waterways, and natural areas. Noxious weeds can have adverse ecological and economic impacts to these resources by displacing and outcompeting plants in both natural ecosystems and managed lands. The VAAFM passed the Noxious Weed Quarantine Rule in 2002 to regulate the importation, movement, sale, possession, cultivation, and distribution of certain invasive plants and most recently updated the list in 2012 (VAAFM, 2012). The VAAFM is responsible for maintaining the statewide prohibited noxious weed list and updates to that list, as necessary. Plants on the noxious weed list are prohibited from sale in the nursery and landscaping trades. In addition to the VAAFM, noxious weeds in Vermont are addressed by the Vermont Invasive Exotic Plant Committee. The committee does not have regulatory authority, but rather endeavors to educate the public and policymakers on invasive species issues and promote cooperative efforts to address invasive species concerns. This committee also makes recommendations to the VAAFM on species to be considered for the Quarantine Rule[78]. The Vermont Invasive Exotic Plant Committee includes representatives from state and federal government, nonprofit organizations, private industry, and concerned citizens to address invasive plant issues in Vermont.

A total of 39 state-listed noxious weeds are regulated in Vermont as set forth in the Quarantine Rule #3 – Noxious Weeds (VAAFM, 2012). Noxious weed species are designated as Class A or Class B[79] based on the native origin of the plant, known distribution, potential for spread within Vermont, feasibility of control prevention, and regional and national factors including designation as a federal noxious weed. In addition, the Vermont noxious weed list includes all weeds listed on the Federal Noxious Weed List (7 CFR 360.200, as amended) as Class B Noxious Weeds. Of the species specifically identified on the Vermont noxious weed list, 23 are terrestrial and 16 are aquatic species (VAAFM, 2012). The following species by vegetation type are regulated in Vermont:

- **Aquatic –** fanwort (*Cabomba caroliniana*), Brazilian waterweed/elodea (*Egeria densa*), waterthyme/hydrilla (*Hydrilla verticilata*), Indian swampweed/East Indian hygrophila (*Hygrophila polysperma*), parrot feather watermilfoil (*Myriophyllum aquaticum*),

[78] Vermont's Quarantine Rule establishes authority in the VAAFM to quarantine the state against any harmful food, plants, animals, crops, or livestock that may be harmful to the population.

[79] Class A means any noxious weed that is not native to the State, not currently known to occur in the State on the date of listing, and poses a serious threat to the State. Class B means any noxious weed that is not native to the state, is of limited distribution statewide, and poses a serious threat to the State, or any other designated noxious week being managed to reduce its occurrence and impact in the State, including those on the Federal Noxious Weed List.

twoleaf/variable watermilfoil (*M. heterophyllum*), Eurasian watermilfoil (*M. spicatum*), eared watermoss/giant salvinia (*Salvinia auriculata*), giant salvinia (*S. biloba*), giant salvinia (*S. herzogii*), Kariba-weed/giant salvinia (*S. molesta*), frogbit (*Hydrocharis morsus-ranae*), yellow floatingheart (*Nymphoides peltata*), curly pondweed (*Potamogeton crispus*), water chestnut (*Trapa natans*), and brittle waternymph/European naiad (*Najas minor*).

- **Trees, Shrubs and Vines –** tree-of-heaven (*Ailunthus altissima*), Oriental bittersweet (*Celastrus orbiculatus*), showy fly honeysuckle/bell honeysuckle (*Lonicera* x *bella* [*morrowii* x *tatarica*]), Japanese honeysuckle (*L. japonica*), Amur honeysuckle (*L. maackii*), Morrow's honeysuckle (*L. morrowii*), Tatarian honeysuckle (*L. tatarica*), common buckthorn (*Rhamnus cathartica*), glossy buckthorn (*R. frangula* [syn. *Frangula alnus*]), Norway maple (*Acer platanoides*), Amur maple (*A. ginnala*), common barberry (*Berberis vulgaris*), Japanese barberry (*B. thunbergii*), and burningbush (*Euonymus alatus*).
- **Terrestrial Forbs, Grasses, and Grass-like Plants –** white/pale swallow wort (*Vincetoxicum hirundinaria* [syn. *Cynanchum vincetoxium*]), Louise's/black swallow wort (*Vincetoxicum nigrum* [syn. *Cynanchum louiseae*]), bishop's goutweed/snow-on-the-mountain (*Aegopodium podograria*), garlic mustard (*Alliaria petiolata*), flowering rush (*Butomus umbellatus*), Japanese knotweed (*Fallopia japonica* [syn. *Polygonum cuspidatum*]), purple loosestrife (*Lythrum salicaria*), European common reed (*Phragmites australis* ssp. *australis*), and pale yellow/yellow flag iris (*Iris pseudacorus*).

In addition, "varieties, cultivars, hybrids, and/or subspecies that have been shown through scientific research and analysis not to be invasive are exempt" from the Quarantine Rule (VAAFM, 2012). Currently two plant cultivars are included on the exempted list, *Rhamnus frangula* (syn. *Frangula alnus*) "Asplenifolia" and *Rhamnus frangula* (syn. *Frangula alnus*) "Fine Line."

14.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Vermont, divided among mammals[80], birds[81], reptiles and amphibians[82], and invertebrates[83]. Terrestrial wildlife consist of those species, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals, furbearers[84], nongame animals, game birds, waterfowl, and migratory birds as well as their habitats within Vermont. A discussion of non-native and/or invasive terrestrial wildlife species is also included within this section. Information regarding the types and location of native and non-native/invasive wildlife is useful for assessing the

[80] 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, 2015c)

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

[82] 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, 2015c)

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

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

importance of any impacts to these resources or the habitats they occupy. According to Vermont Fish and Wildlife Department (VFWD) Natural Heritage Inventory, the state is home to 55 mammal species, 265 bird species, 41 reptile and amphibian species, an estimated 15,000 to 36,000 invertebrate species, and 92 fish species (Vermont Fish and Wildlife Department, 2005) (Vermont Fish and Wildlife Department, 2015b) [85].

Mammals

Common and widespread mammalian species in Vermont include white-tailed deer (*Odocoileus virginianus*), woodchuck (*Marmota monax*), deer mice (*Peromyscus spp.*), raccoon (*Procyon lotor*), squirrel (*Sciurus carolinensis*), and moose (*Alces alces*). Other species such as black bear (*Ursus americanus*), beaver (*Castor canadensis*), and otter (*Lontra canadensis*) are also common but less widespread. Most mammal species are widely distributed throughout the state; however, some species such as lynx (*Lynx canadensis*), bobcat (*Lynx rufus*), and beaver may be more commonly encountered in the heavily forested central and northern portions of the state. One endangered mammal, the Indiana bat (*Myotis sodalis*) is known to occur in Vermont. Section 14.1.6.6, Threatened and Endangered Species, discusses this species.

In Vermont white-tailed deer, moose, black bear and wild turkey (*Meleagris gallopavo*) are considered big game species. Small game species include small mammals (e.g., rabbits, gray squirrel), furbearers, and upland and migratory bird species including waterfowl. The following thirteen species of furbearers may be legally hunted or trapped in Vermont: mink (*Neovison vison*), skunk, red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), raccoon, coyote (*Canis latrans*), opossum (*Didelphis virginiana*), weasel (*Mustela spp.*), otter, muskrat (*Ondatra zibethicus*), fisher (*Martes pennant*), bobcat, and beaver.

Vermont has identified 33 mammals as Species of Greatest Conservation Need (SGCN). The SGCN list consists of at-risk species that are rare or declining, and can receive funding from State Wildlife Grants for efforts to prevent fish and wildlife populations[86] from becoming endangered. Although these species have been targeted for conservation they are not currently under legal protection. The SGCN list is updated periodically and is used by the state to focus their conservation efforts and as a basis for implementing their Wildlife Action Plan (Vermont Fish and Wildlife Department, 2005).

Birds

The number of native bird species documented in Vermont varies according to the timing of the data collection effort, changes in bird taxonomy[87], and the reporting organization's method for categorizing occurrence and determining native versus non-native status. The diverse ecological communities (i.e., mountains, large rivers and lakes, swamps, etc.) found in Vermont support a variety of bird species. As of 2015, 265 species of resident and migratory birds have been

[85] http://www.vtfishandwildlife.com/

[86] Population: "Aggregate of individuals of a biological species that are geographically isolated from other members of the species and are actually or potentially interbreeding." (USEPA, 2015c)

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

documented in Vermont. Among the 265 extant[88] species in Vermont, 57 SGCN have been identified (Vermont Fish and Wildlife Department, 2015b)[89].

Vermont is located within the Atlantic Flyway, which generally follows the Atlantic Coast and Appalachian Mountains. The Atlantic Flyway extends from the Arctic islands and coast of Greenland south to eastern Mexico and the Caribbean Sea. Large numbers of migratory birds utilize these flyways and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall. "The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations" (USFWS, 2013a). The USFWS is responsible for enforcing the MBTA and maintaining the list of protected species. The migratory bird species protected under the MBTA are listed in 50 CFR 10.13 (USFWS, 2013a)[90].

Bald eagles (*Haliaeetus leucocephalus*) are protected under the Bald and Golden Eagle Protection Act. According to a 2015 winter survey in Vermont, 51 bald eagles were observed along Lake Champlain, Lake Bomoseen, the Connecticut River, and the upper Winooski River. There are 21 territorial pairs confirmed in the state. (Audubon Vermont, 2016). Golden eagles (*Aquila chrysaetos*) are a transient species in Vermont (Vermont Fish and Wildlife Department, 2015c).

Seventeen Important Bird Areas (IBAs) have also been identified in Vermont, as shown in . 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. These IBAs link global and continental bird conservation priorities to local sites that provide critical habitat for native bird populations.

According to the Vermont Audubon Society, a total of 17 IBAs and 4 IBA complexes have been identified in the state, including breeding[91], migratory stop-over, and feeding areas, and a variety of habitats such as breeding cliffs, islands, boreal forests, river deltas and bottomland forests, mountain lakes, uplands, and other wetland/riparian[92] areas (National Audubon Society, Inc., 2015b).

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[88] Extant: "A species that is currently in existence (the opposite of extinct)." (USEPA, 2015c)

[89] http://www.vtfishandwildlife.com/

[90] http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtintro.html

[91] Breeding range: "The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared" (USEPA, 2015c)

[92] Riparian: "Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands." (USEPA, 2015c)

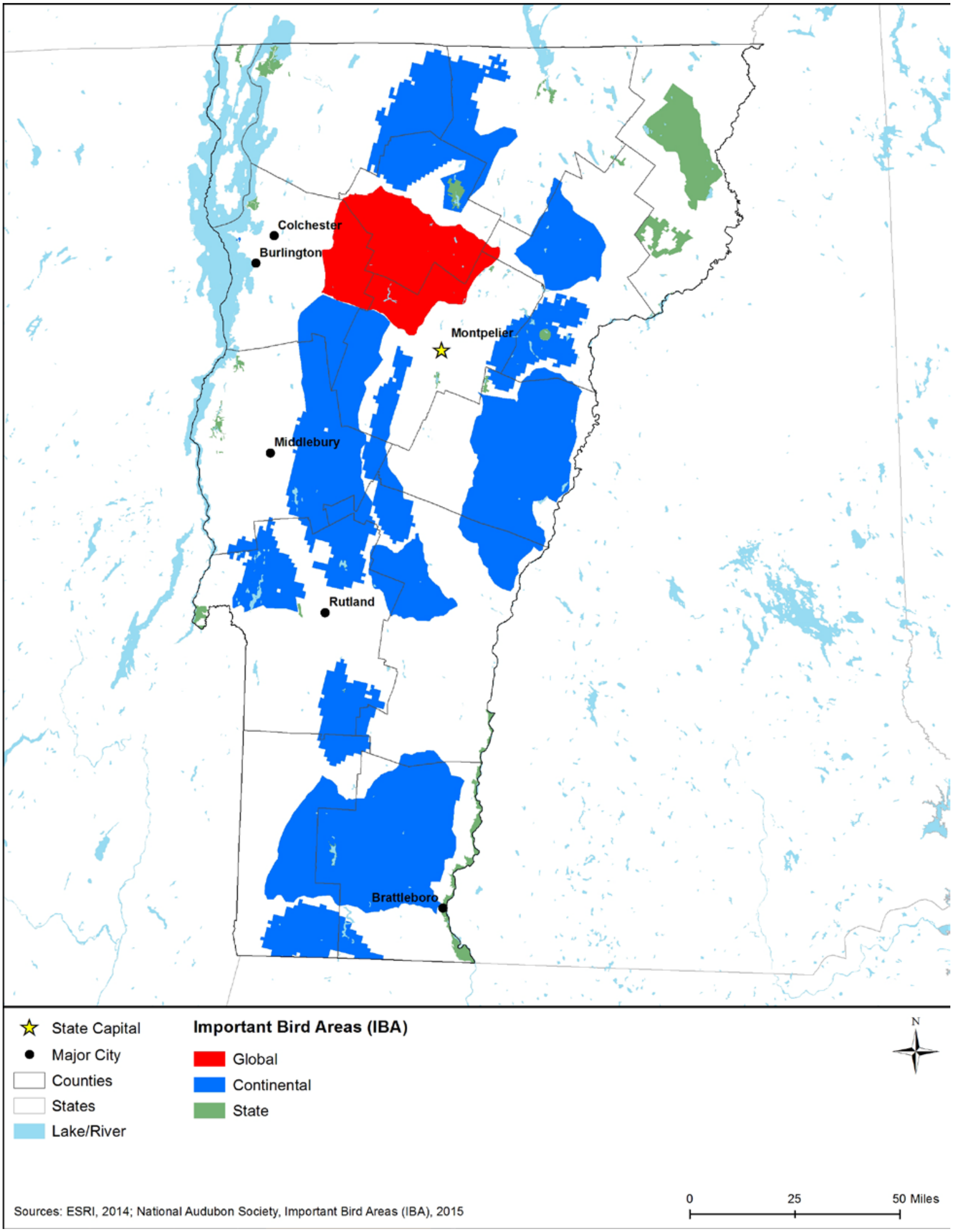

Figure 14.1.6-2: Important Bird Areas of Vermont

These IBAs are widely distributed throughout the state, although the largest concentration of IBAs are located in the Champlain Valley and Green Mountains regions of the state. The Champlain Valley IBAs are mostly river deltas, floodplain and bottomland forests, and wetlands that provide breeding and migratory stopover habitat for osprey, black tern, American and least bittern, Upland sandpiper, great blue heron and many marsh and waterfowl species (Audubon Vermont , 2015). Other IBAs in the Green Mountains include boreal and mountain lake areas with associated forest, bog, and wetland habitat, bogs such as are an important breeding locations for upland and mountainous species such as gray jay, black-backed woodpecker, boreal chickadee, spruce grouse, common loon, goshawk, and sora.

Reptiles and Amphibians

A total of 41 native reptile and amphibian species occur in Vermont. Of these, 11 are frogs and toads, 9 salamanders, 1 lizard, 8 turtles, and 12 snakes (Vermont Fish and Wildlife Department, 2015b). These species occur in a wide variety of habitats across the state, with some having widespread distribution and others being limited to a smaller region or locations in the state. Of the 41 native reptile and amphibian species, 19 SGCN have been identified.

Vermont's reptile and amphibian species are classified as wild animals. Vermont rules allow for the take[93] of "wild animals, other than protected birds or game or fur-bearing animals" (10 Appendix V.S.A. 001).

Invertebrates

Vermont is believed to be home to an estimated 15,000 to 30,000 species of invertebrates, including a wide variety of dragonflies, damselflies, butterflies, moths, mayflies, and beetles. These invertebrates provide an abundant food source for birds, reptiles, amphibians, fish, mammals, and other invertebrates. In the United States, one third of all agricultural output depends on pollinators[94]. In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity[95] and plant diversity. "As a group, native pollinators are threatened by habitat loss, pesticides, disease, and parasites" (Natural Resources Conservation Service, 2009). The number of invertebrate species in Vermont is unknown, but estimates for insects alone have ranged from 15,000 to 20,000. Life history, distribution, and abundance information is limited to a small number of Vermont's invertebrates - many of the state's invertebrates have not yet been scientifically described. Given this lack of information on invertebrate species within the state, Vermont has chosen to focus identification SGCN on species and species groups for which adequate information is available, resulting in a list of 192 invertebrate SGCN (Vermont Fish and Wildlife Department, 2005) [96].

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93 "Take" refers to direct harm to a species or habitat destruction.

94 Pollinators: "Animals or insects that transfer pollen from plant to plant." (USEPA, 2015c)

95 Diversity: "An ecological measure of the variety of organisms present in a habitat." (USEPA, 2015c)

96 http://www.vtfishandwildlife.com/

Invasive Wildlife Species

The link between nonnative forest insect and disease infestations and firewood as a major source of these infestations has been widely recognized. Vermont currently has no comprehensive firewood restrictions, although rules regulating the importation of untreated firewood into the state are intended to be adopted in the near future (Vermont Department of Forests, Parks and Recreation, 2015a). Currently Vermont State Parks, Vermont State Forests, and the Green Mountain National Forest limit firewood to that originating from Vermont or that is kiln dried and in original packaging. Federal restrictions currently exist for firewood from Canada, as well as from areas known to have emerald ash borer (*Agrilus planipennis)* or Asian longhorned beetle (*Anoplophora glabripennis*) infestations. This quarantine area continues to expand and currently includes states adjacent to or near Vermont, including New York, Massachusetts, and Connecticut.

14.1.6.5. Fisheries and Aquatic Habitat

This section discusses the aquatic wildlife species in Vermont, including freshwater fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented. Fish in Vermont are commonly split in two groups – coldwater species and coolwater/warmwater species, reflecting the general habitats in which fish occur. A distinctive feature of the Vermont landscape with regard to aquatic wildlife is the expansive Lake Champlain on the western state border, the Connecticut River on the eastern border, and the over 7,000 miles of rivers and streams and more than 800 lakes and ponds providing a wide variety of fisheries habitat. No essential fish habitat (EFH) identified by the Magnuson-Stevens Fishery Conservation and Management Act exists in Vermont. Critical habitat for threatened and endangered fish species, as defined by the ESA, does not exist within Vermont.

Freshwater Fish

Vermont is home to 92 species of freshwater fish, ranging in size from small minnows to larger species such as salmon and sturgeon. These species are grouped into 21 families, as follows: bullheads/catfishes, burbot, drums, eel, gars, killfishes, lamprey, minnows, mooneyes, mudminnows, perches, pikes/pickerels, salmon/trout, sculpins, smelt, sticklebacks, sturgeons, suckers, sunfish/bass, temperate basses, and trout-perch. Among these species are several important recreational and game fish, such as yellow perch, walleye, catfish, sunfishes, bass, northern pike, trout, and lake salmon. Of the 92 extant species in Vermont, 31 SGCN have been identified (Vermont Fish and Wildlife Department, 2015b).

Fish communities in Vermont follow a roughly defined distribution between two general habitat types: habitats adjacent to and including Lake Champlain and other large lakes, and those of mountain streams, lakes, and ponds. Large lake and river habitat fish species include sturgeon, Atlantic salmon (*Salmo salar*), lamprey (*Petromyzon marinus*), walleye (*Sander vitreus*), and American eel (*Anguilla rostrate*), among others. Mountain lake and stream fish species include bass (*Ambloplites spp.*), pike (*Esox Lucius*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), and rainbow trout (*Oncorhynchus mykiss*). Some fish species use both habitat types (for example but not limited to walleye, yellow perch (*Perca flavescens*), and Atlantic salmon), but many tend to occur in one of the two general habitat types.

The salmon family is considered a very important fish family in the United States for many reasons, including commercial and recreational fishing value, their role in aquatic and terrestrial ecosystems, and their role in fisheries management. The landlocked Atlantic salmon can be found in several of Vermont's cold, clear, well-oxygenated lakes including Lake Champlain and Lake Dunmore in the Champlain Valley region, and Lake Memphremagog in the Green Mountains region of the state. They are named "landlocked" because they complete their entire lifecycle in freshwater, unlike other sea-run salmon that spend most of their lives in salt water. In addition to cold lake habitats, the landlocked Atlantic salmon utilizes tributary rivers of these lakes for spawning and nursery habitat. Ideal spawning habitat requires riverbeds with rapidly flowing water with good gravel substrate (Vermont Fish and Wildlife Department, 2015b).

Freshwater fish and associated freshwater habitats are considered one of the most highly threatened ecosystems based on the vast decline in species population numbers. Approximately 40 percent of fish species in North America are considered at risk or vulnerable to extinction[97] Major threats to freshwater fisheries include habitat modification and destruction (dams, culverts, weirs, urban development, and agricultural practices), overfishing, invasive species, and environmental pollution and impaired water quality. Among freshwater fish in Vermont and the northeastern United States in general, three groups of fish are considered to be the most threatened by habitat loss and degradation[98]: headwater fishes (American brook lamprey [*Lethenteron appendix*], channel darter [*Percina copelandi*], eastern sand darter [*Ammocrypta pellucida*], stonecat [*Noturus flavus*]), lake fishes (lake sturgeon [*Acipenser fulvescens*], lake chub [*Couesius plumbeus*]), and migratory fishes (e.g., American eel, American shad [*Alosa sapidissima*], Atlantic salmon). (National Fish Habitat Board, 2010) (USFWS, 2015e)

Shellfish and Other Invertebrates

A complete inventory of freshwater mollusks and crustaceans has not been completed for Vermont. Familiar freshwater bivalve[99] species include a variety of mussel species, including the eastern elliptio mussel (*Elliptio complanata*) that occurs in Vermont. Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), other Vermont freshwater invertebrates that spend their lives in aquatic systems include crayfish, amphipods, and snails.

Vermont has identified 18 native freshwater mussel species, 13 of which are identified as SGCN. In addition, 14 snails and 3 crustaceans have been identified as SGCN (Vermont Fish and Wildlife Department, 2005) (Vermont Fish and Wildlife Department, 2015d)[100]. One

[97] Extinction: "The disappearance of a species from part or all of its range." (USEPA, 2015c)
[98] Degradation: "The reduction of the capacity of the environment to meet social and ecological objectives, and needs. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards." (USEPA, 2015c)
[99] Bivalve: "An aquatic mollusk whose compressed body is enclosed within a hinged shell." (USEPA, 2015c)
[100] http://www.vtfishandwildlife.com/

endangered mussel (dwarf wedgemussel [*Alasmidonta heterodon*]) is located in Vermont and is discussed in Section 14.1.6.6, Threatened and Endangered Species.

Invasive Aquatic Species

As previously discussed, Vermont has adopted regulations that prohibit or regulate the importation, movement, sale, possession, cultivation, and distribution of certain invasive plants. In addition, Vermont has established regulations against aquatic nuisance species (10 V.S.A. 50 § 1454), which restricts the transportation of "an aquatic plant or aquatic plant part, zebra mussels (*Dreissena polymorpha*), quagga mussels (*Dreissena bugensis*), or other aquatic nuisance species" as identified by the VAAFM. In addition to aquatic plants and zebra and quagga mussels, other troublesome invasive aquatic species include alewife (*Alosa psuedoharengus*), rusty crayfish (*Orconectes rusticus*), and the nuisance algae didymo (*Didymosphenia geminate*) (Vermont Department of Environmental Conservation, 2015a).

14.1.6.6. 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 Vermont. The USFWS New England Field Office has identified four endangered species known to occur in Vermont, and one threatened species (USFWS, 2014b) (USFWS, 2016a). None of the listed species have designated critical habitat in Vermont (USFWS, 2016a). There are no candidate[101] species identified by USFWS as occurring within the state (USFWS, 2014c). The five listed species include two mammal, one invertebrate, and two plants, and are discussed in detail under the following sections (USFWS, 2014b).

Mammals

The Indiana Bat (*Myotis sodalis*) is the sole federally endangered mammal listed for Vermont (Table 1414.1.6-4). It is located in wooded areas and rocky outcroppings of western Vermont. The Northern Long-eared Bat is the sole threatened species found in Vermont. Information on habitat, distribution, and threats to the survival and recovery of the Indiana Bat and the Northern Long-eared Bat in Vermont is provided below.

Table 14.1.6-4. Federally Listed Mammal Species of Vermont

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Indiana Bat	Myotis sodalis	E	No	In wooded areas of western Vermont, primarily in the Champlain Valley region.
Northern Long-eared Bat	Myotis septentrionalis	T	No	Eastern and north central United States

Source: (USFWS, 2014b)
[a] E = Endangered, T= Threatened

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

Indiana Bat. The Indiana bat is a small, insectivorous[102] mammal measuring approximately 1.5 to 2 inches long and strongly resembles the more common little brown bat (*Myotis lucifugus*). Federally listed in 1967 *(32 FR 4001, March 11, 1967)*, the Indiana bat was grandfathered into the ESA and classified as endangered (Harrington, 1981) (USFWS, 2010a). Regionally, this species is found in the central portion of the eastern United States, from Vermont west to Wisconsin, Missouri, and Arkansas, and south and east to northwest Florida. In Vermont, there are four counties in western Vermont where the Indiana bat is known to occur (USFWS, 2015f).

Indiana Bat Photo credit: USFWS

Indiana bats roost in trees during the day and feed at night in a variety of habitats, although they prefer streams, floodplain forests, ponds, and reservoirs in wooded and semi-wooded areas. Females and males roost separately in colonies in dead or dying trees raising a single offspring each year. In the fall, Indiana bats migrate to the vicinity of their hibernation[103] sites (hibernacula) to mate and accumulate fat reserves for their winter hibernation (USFWS, 2010a).

Threats to this species include the disturbance and intentional killing of hibernacula and maternity colonies, disturbances to air flow in caves from the improper installation of security gates, habitat fragmentation[104] and degradation, the use of pesticides or other environmental contaminants, and White Nose Syndrome. White Nose Syndrome is a rapidly spreading fungal disease that afflicts hibernating bats. Although all of the life stages of Indiana bat are vulnerable to adverse impacts, they are most sensitive during hibernation, thus conservation efforts have focused on this vulnerable period (USFWS, 2015g).

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 United States, its range includes most of the eastern and north central states, including 14 Vermont counties (USFWS, 2015h).

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, 2015i).

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

[103] Hibernation: "The act of passing the winter in a dormant state in which the metabolism is slowed to a tiny fraction of normal." (USFWS, 2016b)

[104] Fragmentation: "The breaking up of large and continuous ecosystems, communities, and habitats into smaller areas that are surrounded by altered or disturbed land or aquatic substrate." (USEPA, 2015c)

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. (USFWS, 2015g)

Invertebrates

The dwarf wedgemussel (*Alasmidonta heterodon*) is the sole federally listed invertebrate listed for Vermont as shown in Table 14.1.6-5. Information on habitat, distribution, and threats to the survival and recovery of the dwarf wedgemussel in Vermont is provided below.

Table 14.1.6-5. Federally Listed Invertebrate Species of Vermont

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Dwarf Wedgemussel	*Alasmidonta heterodon*	E	No	In Southern Vermont region along the eastern border with New Hampshire, in portions of the Connecticut River with slow to moderate currents with gravel and sandy bottoms.

Source: (USFWS, 2014b)
[a] E = Endangered

Dwarf Wedgemussel. The endangered dwarf wedgemussel is a small, brown or yellowish-brown freshwater mussel that is usually less than 1.5 inches in length (USFWS, 2010b). It was federally listed as endangered in 1990 *(55 FR 9447 9451, March 14, 1990)* throughout its range. In Vermont it is believed or known to occur in the Connecticut River along the eastern border with New Hampshire (USFWS, 2015j).

Dwarf Wedgemussel Photo credit: USACE

The dwarf wedgemussel are sedimentary filter feeders that feed off suspended particles and algae. They inhabit creek and river areas with slow to moderate current and sand, gravel, or muddy bottoms. This species requires either the tessellated darter (*Etheostoma olmstedi*) or the mottled sculpin (*Cottus bairdi*) to host larvae in their gills while the mussels develop. The current threats to this species include silt deposition, water quality degradation, sedimentation from development, and agricultural runoff (USFWS, 2010b).

Plants

Jesup's milk-vetch (*Astragalus robbinsii var. jesupi)* and the northeastern bulrush *(Scirpus ancistrochaetus)* are both federally endangered plants listed in Vermont as shown in Table 14.1.6-6. They are both located in southeastern Vermont along the Connecticut River.

Information on habitat, distribution, and threats to the survival and recovery of the Indiana Bat in Vermont is provided below.

Table 14.1.6-6. Federally Listed Plant Species of Vermont

Common Name	Scientific Name	Federal Status [a]	Critical Habitat	Habitat Description
Jesup's Milk-vetch	*Astragalus robbinsii var. jesupi*	E	No	Shoreline of the Connecticut River in Southern Vermont region.
Northeastern Bulrush	*Scirpus ancistrochaetus*	E	No	Wetlands of southeastern Vermont in Southern Vermont region.

Source: (USFWS, 2014b)
[a] E = Endangered, T = Threatened, NA = Not Applicable

Jesup's Milk-vetch. Jesup’s milk-vetch is a member of the legume family and emerges from river banks in April every year (Jun 5, 1987, 52 FR 21481 21484) (USFWS, 2015k). The plant ranges from 8 inches to 24 inches in height and has 9 to 17 small leaflets with small violet flowers and seedpods. In Vermont, the plant is only believed or known to occur in Windsor County on the Connecticut River (USFWS, 2010c).

Jesup’s Milk-vetch Photo credit: USFWS/Vermont Nongame and Natural Heritage Program

Typically, ice scouring and flooding of the rocky habitat have kept other non-native plant species from competing for habitat, but with damns restricting river flow and climate change, the species is becoming scarcer. This scarcity of the species further makes the plant susceptible to disease from lack of genetic variety. Additional threats include riverfront development and trampling by humans (USFWS, 2010c).

Northeastern bulrush Photo credit: USFWS

Northeastern Bulrush. The northeastern bulrush is a plant with narrow leaves and a drooping head with chocolate-brown florets. It is a wetland plant in the sedge family (Cyperaceae) that is very similar to other bulrushes, but its flowers and seeds are structurally different. This species was federally listed as endangered in 1991 (56 FR 21091 21096, May 05, 1991). The northeastern bulrush is known to occur from New Hampshire south to Virginia, with the most known occurrences in Pennsylvania (USFWS, 2010d). In Vermont, the species is known to occur in the counties of Windham and Windsor in southeastern part of Vermont (USFWS, 2015l).

The northeastern bulrush occurs in palustrine wetlands[105] and vernal pools[106] with seasonally fluctuating water levels. The current threats to the northeastern bulrush include alterations to the surrounding hydrology,[107] either by drier or wetter conditions (USFWS, 2006) (USFWS, 2010d).

14.1.7. Land Use, Recreation, and Airspace

14.1.7.1. Definition of the Resources

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

Land Use and Recreation, and Airspace

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

[105] Palustrine wetlands: “Palustrine wetlands include nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens.” (USEPA, 2015c)
[106] Vernal Pools: “seasonal depressional wetlands that occur under the Mediterranean climate conditions of the West Coast and in glaciated areas of northeastern and midwestern states. They are covered by shallow water for variable periods from winter to spring, but may be completely dry for most of the summer and fall” (USEPA, 2015c)
[107] Hydrology: “The way water moves and is distributed via precipitation, runoff, storage and evaporation.” (USEPA, 2015c)

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 (U.S. Geological Survey, 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 in a regional fashion.

Airspace

Airspace is generally defined as the space lying above the earth, above a certain area of land or water, or above a nation and the territories that it controls, including territorial waters (Merriam Webster Dictionary, 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 (Federal Aviation Administration, 2015b).

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

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

14.1.7.2. Specific Regulatory Considerations

Appendix C summarizes numerous federal laws and regulations that, to one degree or another, affect land use in Vermont. 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. In this manner, local planning commissions are responsible for community planning through municipal plans.

Vermont employs the Use Value Appraisal law (or Current Use law) which allows the valuation and taxation of farm, forest, and conservation land based on continuation of that land use, rather than on the land's value in the market place. This has helped maintain these land use types and has slowed development of these lands. Approximately one-third of Vermont's total land area (approximately 18,000 properties and more than 2.3 million acres) is governed by this law/program (Vermont Department of Taxes 2015).

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

14.1.7.3. Land Use and Ownership

For the purposes of this analysis, Vermont has been classified into three primary land use groups: forest and woodlands,[108] agricultural,[109] and developed land.[110] Land ownership within Vermont has been classified into four main categories: private, federal, state, and tribal.

Land Use

Forest and woodlands is comprised of the largest portion of land use with 77 percent of Vermont's total land occupied by this category (Table 14.1.7-1 and Figure 14.1.7-1). Agriculture is the second largest area of land use with 14 percent of the total land area. Developed areas account for approximately 5 percent of the total land area. The remaining percentage of land includes public land and other land covers, shown in Table 14.1.7-1 that are not associated with specific land uses. (U.S. Geological Survey, 2012c).

Table 14.1.7-1: Major Land Uses in Vermont

Land Use	Square Miles	Percent of Land
Forest and Woodland	7,393	77%
Agricultural Land	1,380	14%
Developed Land	445	5%

Source: (U.S. Geological Survey, 2012c)

[108] Forest and woodlands: Areas characterized by tree cover (natural or semi-natural woody vegetation, generally greater than 6 meters tall); tree canopy accounts for 25-100 percent of the cover. (U.S. Geological Survey, 2012d)

[109] Agricultural: Areas characterized by herbaceous vegetation that has been planted or is intensively managed for the production of food, feed, or fiber; or is maintained in developed settings for specific purposes. Herbaceous vegetation accounts for 75-100 percent of the cover. (U.S. Geological Survey, 2012d)

[110] Developed: Areas characterized by a high percentage (30 percent or greater) of constructed materials (e.g., asphalt, concrete, buildings, etc.). (U.S. Geological Survey, 2012d)

Forest and Woodland

Forest and woodland areas can be found throughout the state. Vermont is densely forested except for the Champlain and Connecticut River Valleys. Small parcels of agricultural land near major rivers break up the heavily forested areas (Figure 14.1.7-1). Nearly 80 percent of forest and woodland is privately owned. Families and individuals own approximately 61 percent of the forestland, corporations own 15 percent, and other private entities own 3 percent (USFS, 2013). Section 14.1.6, Biological Resources, presents additional information about terrestrial vegetation.

State Forests

State Forests account for approximately 273 square miles of state land (Vermont Agency of Natural Resources, 2014a). The Department of Forests, Parks and Recreation manage the State Forests. The 2010 Vermont Forest Resources Plan states, “That sustainable forests begin with healthy forests. And that managing forests sustainably involves the recognition of connections among ecological, social, and economic systems to maintain forest health while preserving options for future generations and meeting the needs for the present” (Division of Forests, 2010).

Private Forest and Woodland

Private landowners collectively own nearly 5,900 square miles (80 percent) of forest and woodlands in Vermont. The large majority of these private landowners are families with more an estimated 43,000 forest ownerships of nearly 4,500 square miles. The majority of the ownerships range in size from 10-49 acres. The private landowners have a variety of reasons for owning forest and woodlands including aesthetics, nature, wildlife, private, and residential use. Activities on these lands include recreation, harvesting trees for personal and commercial use, trails, and non-timber forest products (USFS, 2015a).

Agricultural Land

Agricultural land exists in every region of the state, with the largest concentrations in western Vermont near Lake Champlain (Figure 14.1.7-1). Approximately 14 percent of Vermont's total land area is classified as agricultural land (1,380 square miles). In 2012, families or individuals owned and operated 82 percent of the 7,338 farms in Vermont, with the average farm size of 171 acres (U.S. Department of Agriculture, 2012). Some of the state's largest agricultural uses include dairy, maple syrup, hay, and apples (U.S. Department of Agriculture, 2014). For more information by county, access the USDA Census of Agriculture website: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Vermont/.

Developed Land

Developed land in Vermont is concentrated within major metropolitan areas and surrounding cities, towns, and suburbs. Approximately 5 percent of Vermont land is developed and these areas are utilized for residential, commercial, industrial, recreational, and government purposes. Table 14.1.7-2 lists the only developed metropolitan area within the state and the associated population estimate. Figure 14.1.7-1 shows where these areas are located within the Developed Land use category.

Table 14.1.7-2: Top Developed Metropolitan Area

Metropolitan Area	Population Estimate
Burlington-South Burlington	216,167
Total Population of Metropolitan Areas	216.167
Total State Population	626,562

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

Land Ownership

Land ownership within Vermont has been classified into three main categories: private, federal, and state.

Private Land

The majority of land in Vermont is privately owned, with most of this land falling under the land use categories of agricultural, forest and woodland, and developed. Private land exists in all regions of the state[111], including within the Green Mountain National Forest.

Federal Land

The federal government manages approximately 677 square miles (7 percent) of Vermont land with a variety of land types and uses, including a military airfield, military range, national park, national forest, and national wildlife refuges (Figure 14.1.7-1) (U.S. Geological Survey, 2014e). Four federal agencies manage federal lands throughout the state (Table 14.1.7-3).

Table 14.1.7-3: Federal Land in Vermont

Agency [a]	Square Miles	Representative Type
Department of Defense	20.6	Military Airfield and Military Range
U.S. Fish and Wildlife Service	51.5	National Wildlife Refuges
National Park Service	1.0	National Historical Park
U.S. Forest Service	604.4	Green Mountain National Forest
Total	**677.5**	

[a] Table identifies land wholly managed by the Agency; additional properties may be managed by or affiliated with the Agency.
Sources: (U.S. Geological Survey, 2014e)

- The Department of Defense owns and manages 20.6 square miles used for military airfields and military ranges (DoD, 2014);
- The U.S. Fish and Wildlife Service owns and manages 51.5 square miles consisting of two National Wildlife Refuges in Vermont (USFWS, 2014d) (USFWS, 2014e);
- The National Park Service manages one square mile consisting of a National Historical Park (National Park Service, 2015b); and
- The U.S. Forest Service (USFS) owns and manages 604.4 square miles set aside as the Green Mountain National Forest (USFS, 2015b).

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

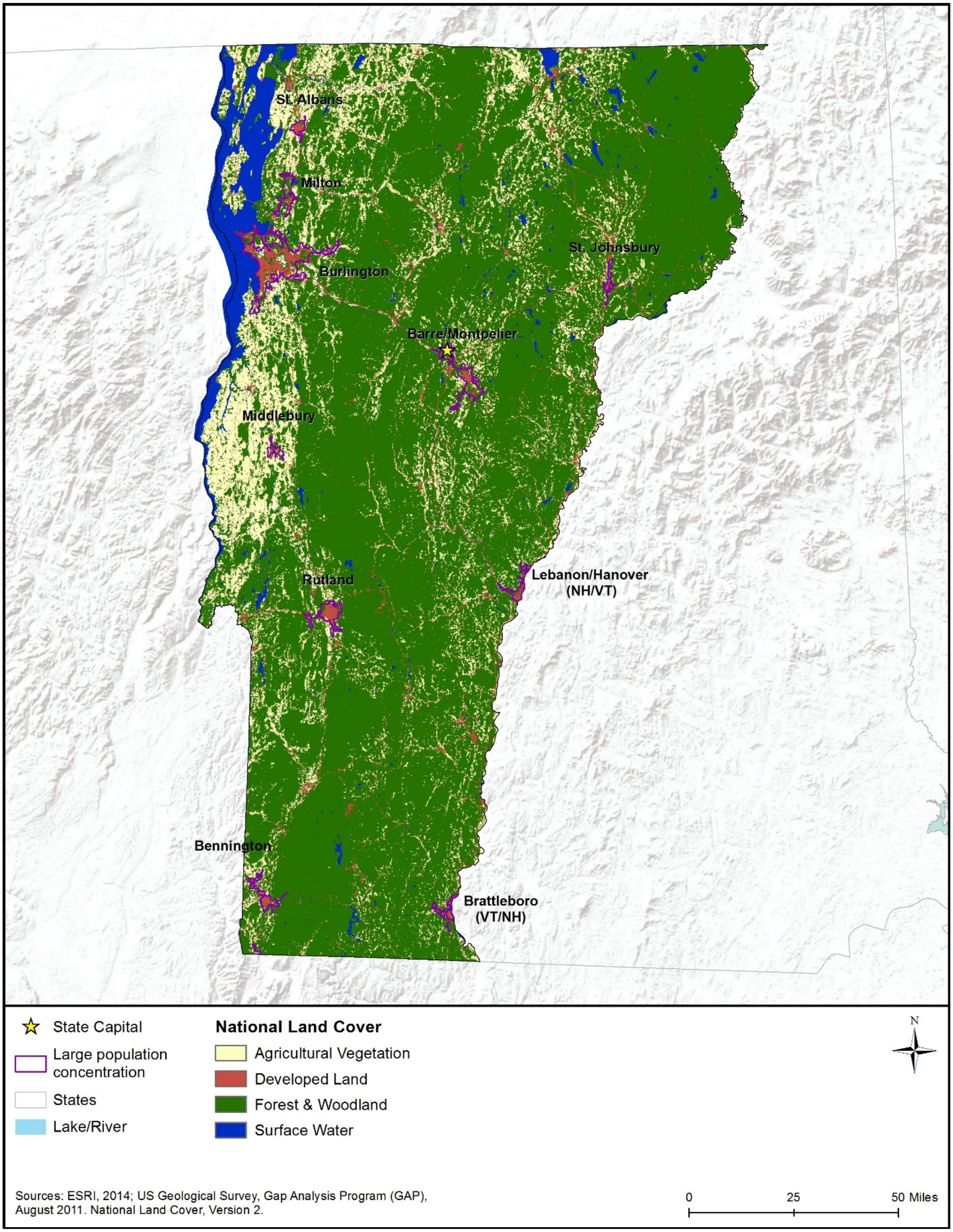

Figure 14.1.7-1: Land Use Distribution

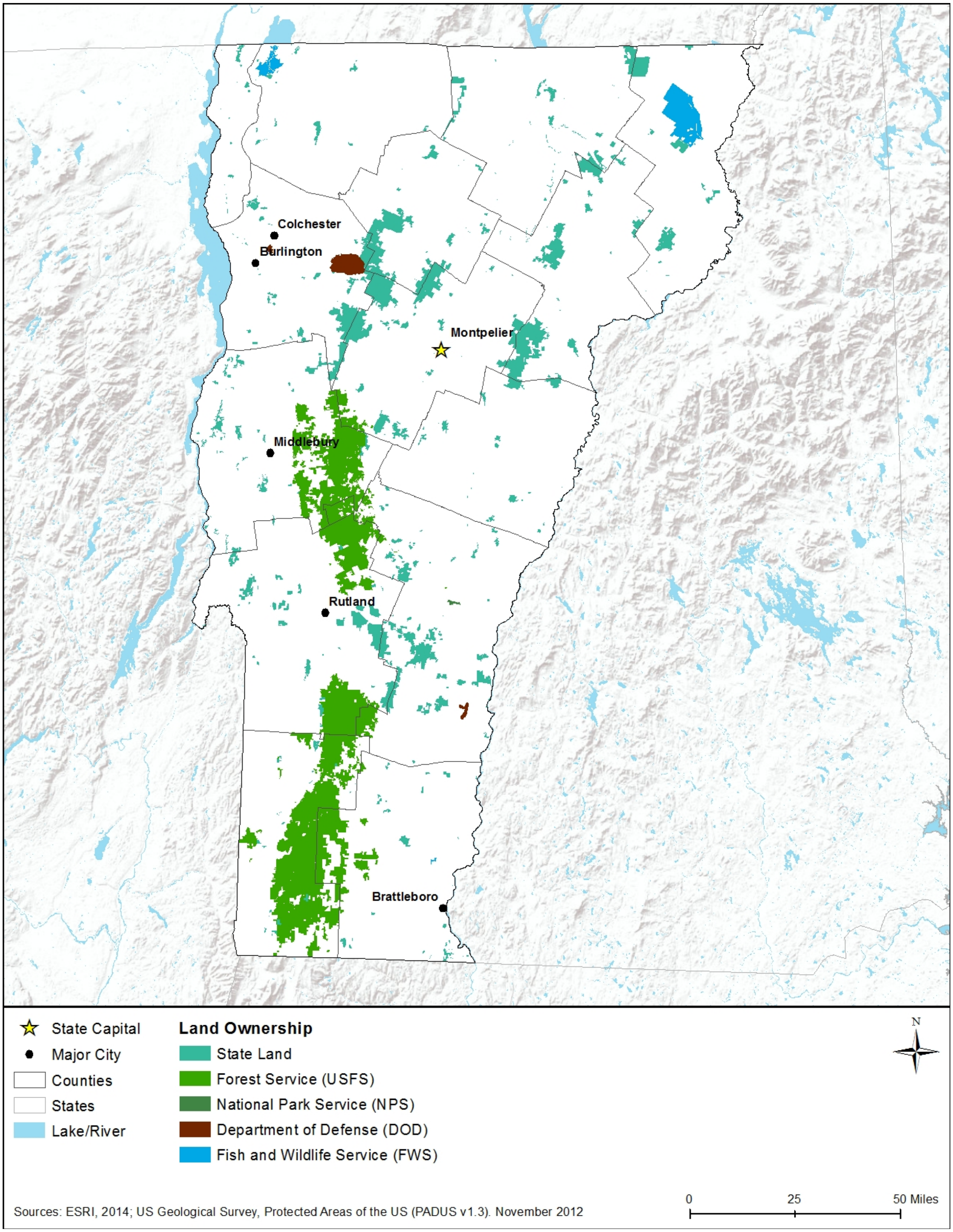

Figure 14.1.7-2: Land Ownership Distribution

State Land

The Vermont state government owns approximately 548 square miles of land comprised of dams, wildlife management areas, forests, natural areas, and recreation areas. Three main state agencies, the Department of Environmental Conservation, Department of Fish and Wildlife, and the Department of Forests, Parks and Recreation manage the majority of state lands (Table 14.1.7-4 and Figure 14.1.7-2) (Vermont Agency of Natural Resources, 2014a).

Table 14.1.7-4: State Land in Vermont

Agency	Square Miles	Type
Department of Environmental Conservation	3	Dams
Department of Fish and Wildlife	195	Access Areas, Pond Sites, Stream Banks, Wildlife Management Areas, Miscellaneous Properties
Department of Forests, Parks and Recreation	350	State Forests, State Parks, Natural Areas, Forest Legacy Properties
Total	**548**	NA

Source: (Vermont Agency of Natural Resources, 2014a)

- The Department of Environmental Conservation manages 10 dams and land associated with the dams ranging in size from less than an acre to 1.4 square miles (871 acres);
- The Vermont Fish and Wildlife Department manages 290 units consisting of 82 Wildlife Management Areas, 132 Access Areas, 27 Pond Sites, 13 Stream Banks, and 36 miscellaneous properties; and
- The Department of Forests, Parks and Recreation manages 96 units consisting of 34 State Forests, 51 State Parks, 4 Natural Areas, and 7 miscellaneous properties (Vermont Agency of Natural Resources, 2014a).

Tribal Land

There are no tribal lands in Vermont.

14.1.7.4. Recreation

Vermont is notable for having large expanses of wilderness, quaint towns, and only a few densely populated areas. On the community level, cities and towns provide an assortment of indoor and outdoor recreational facilities including: community and recreation centers, theaters, museums, athletic fields and courts, multi-use trails, playgrounds, picnicking areas, theme/amusement parks, alpine (downhill) ski resorts and nordic (cross country skiing) centers, and boat launches and marinas. Availability of community-level facilities is typically commensurate to the population's distribution and interests, and the natural resources prominent in the vicinity. There are 54 state parks (State of Vermont, 2009) and 80 Wildlife Management Areas (Vermont Fish and Wildlife Department, 2012b). As the nation's top producer of maple syrup, (U.S. Department of Agriculture, 2015c) the industry is a huge draw for visitors interested in observing the processes and purchasing products. The state's extensive marble and granite resources, industry, and artistry are presented to the public via the Vermont Marble Trail and several quarries with site tours. Federally, the National Park Service, USFS, USFWS, and the

U.S. Army Corps of Engineers (USACE) manage areas in Vermont with substantial recreational attributes.

This section discusses key recreational opportunities and activities representative of various regions of Vermont. The state can be categorized by three distinct recreational regions, each of which are presented in the following sub-sections. For information on visual resources such as National Scenic Byways and state-designated Byways, see Section 14.1.8, Visual Resources; and for information on culturally/historically significant resources (e.g., National Historic Sites, National Historic Landmarks, sites on the National Register of Historic Places, and Natural Heritage Areas), see Section 14.1.14, Cultural Resources.

Northern Region

The Northern Region is bordered by Lake Champlain to the west, Quebec, Canada to the north, the Connecticut River on the east, and other Vermont regions on the south (Figure 14.1.7-3). Some of Vermont's most rural towns are located in this region, as well as Burlington, the largest. This region is best known for Lake Champlain and its islands, remote glacial lakes and streams, Lake Memphremagog, Green River Reservoir and Smugglers' Notch State Parks, Groton State Forest, two 4,000 foot peaks that are the most prominent points on the spine of the Green Mountain Range – Mt. Mansfield and Camel's Hump, and several ski areas, including Stowe Resort. Water and snow sports, fishing, hunting, camping, hiking, biking, and picnicking are popular outdoor activities. Burke, Vermont's "Kingdom Trails" are an extensive network of multi-use trails, most famous for mountain biking activities and events. Top cultural attractions are the St. Anne's Shrine on Lake Champlain's Isle La Motte, Fairbanks Museum and Planetarium, and the Shelburne Museum (of American folk art). Numerous wineries and cheese-makers are established across this region and the beautiful hardwoods harvested from local forests supply materials for hand crafted furniture makers (Vermont Department of Tourism and Marketing, 2015a).

Central Region

The Central Region has diverse opportunities for recreation, as well as abundant arts and cultural activities (Figure 14.1.7-3). The north zone of the Green Mountain National Forest is located in this region and the terrain hosts numerous ski areas. The 272-mile "Long Trail" (the oldest long distance hiking trail in the nation) begins on its own near Killington, after sharing the Vermont segment of the Appalachian Trail that enters the state from Massachusetts. The Robert T. Stafford White Rocks National Recreation Area, Quechee Gorge, Ben and Jerry's Ice Cream Factory, the Vermont Granite Museum, and quarry tours are popular attractions in this region (Vermont Department of Tourism and Marketing, 2015b).

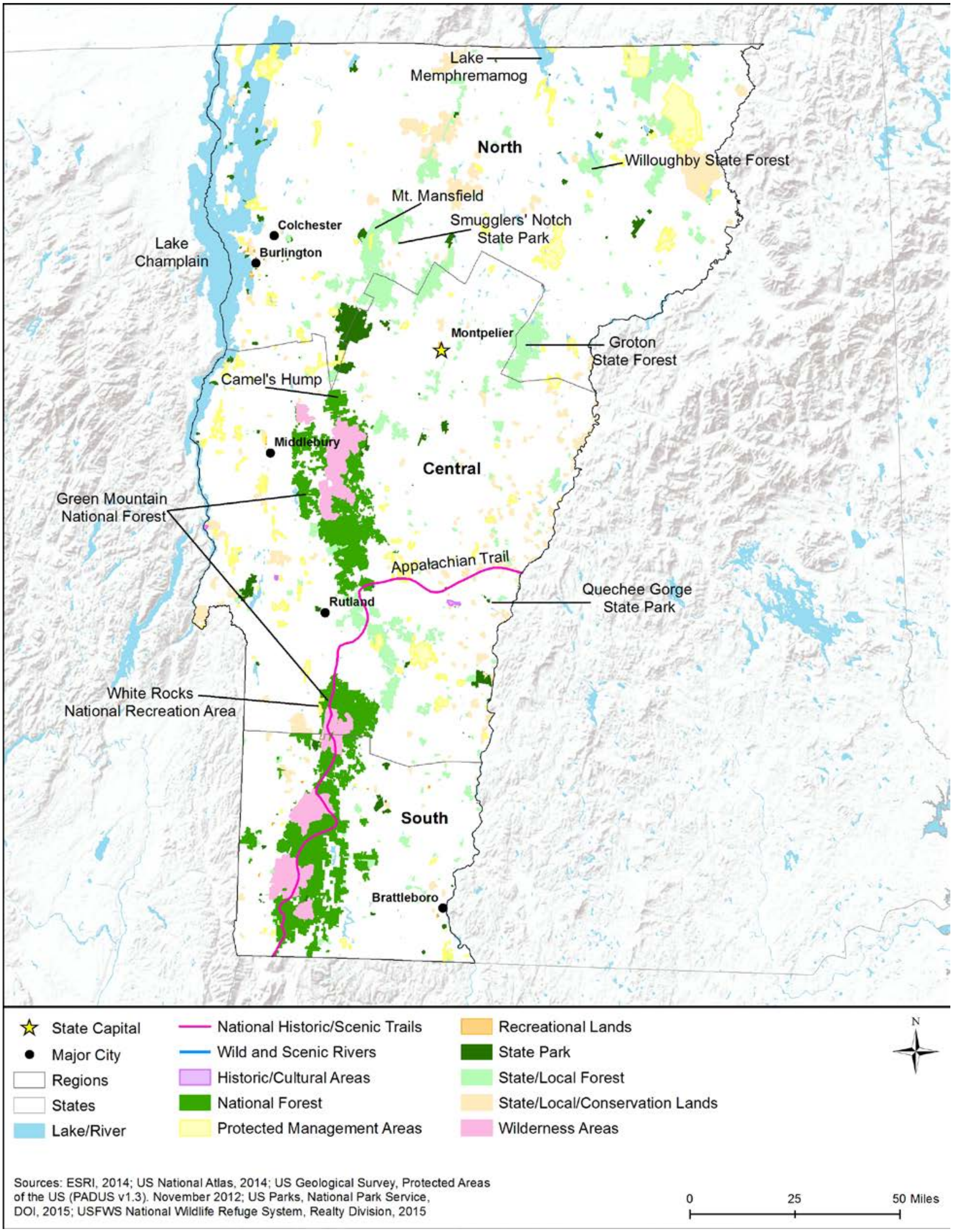

Figure 14.1.7-3: Vermont Recreation Resources

Southern Region

The south zone of the Green Mountain National Forest encompasses more than half of the total area of this region (Figure 14.1.7-4). The forest, mountains, streams, rivers, and foothills support recreational activities associated with several ski areas and resorts, many multi-use trails, campgrounds, and nine state parks. The Appalachian Trail enters the state from Massachusetts and traverses north through the national forest and the White Rocks National Recreation Area, before turning east into New Hampshire. The entire Southern Region (especially the three largest towns: Bennington, Bellows Falls and Brattleboro) is well known for performing arts activities and crafts studios. Music and theater festivals and pottery artists are prevalent. Revolutionary War historical sites, the world's only Covered Bridge Museum, Bellows Falls Gorge, and the "110-mile View" at Brattleboro are popular tourist attractions (Vermont Department of Tourism and Marketing, 2015c).

14.1.7.5. Airspace

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

Airspace Categories

There are two categories of airspace or airspace areas.

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

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 14.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[112] service is based on the airspace classification." (Federal Aviation Administration, 2008).

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

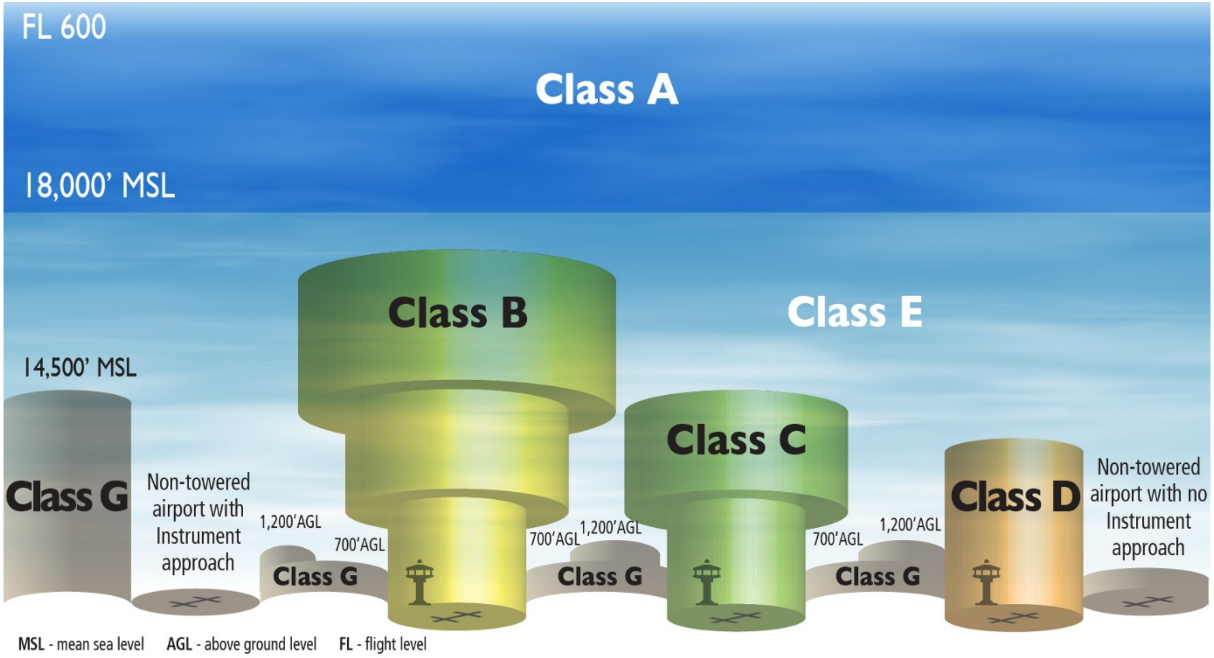

Figure 14.1.7-4: National Air Space Classification Profile

Source: Derived from (Federal Aviation Administration, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[113]. 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).[114]
- **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.

[113] 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).
[114] IFR – Rules for the conduct of flights under instrument meteorological conditions. (Federal Aviation Administration, 2015k)

- **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 (Federal Aviation Administration, 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 14.1.7-5).

Table 14.1.7-5: SUA Designations

SUA Type	Definition
Prohibited Areas	"Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts."
Restricted Areas	"Airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute 14 CFR Part 73."
Warning Areas	"Airspace of defined dimensions, extending from three NM from the U.S. coast, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both."
MOAs	"Airspace of defined vertical and lateral limits established for separating certain military activities (e.g., air combat maneuvers, air intercepts, testing, etc.) from IFR traffic. Whenever an MOA is in use, non-participating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic."
Alert Areas	"Depicted on aeronautical charts to inform non-participating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an alert area must be conducted in accordance with CFRs, without waiver, and pilots of participating aircraft and pilots transiting the area are responsible for collision avoidance."
Controlled Firing Areas (CFAs)	"Activities that, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart CFAs since they do not cause a nonparticipating aircraft to change its flight path."
National Security Areas (NSA)	"Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 99.7. Regulatory prohibitions are issued by System Operations, System Operations Airspace and Aeronautical Information Manual (AIM)

SUA Type	Definition
	Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

Source: (Federal Aviation Administration, 2015d) (Federal Aviation Administration, 2008)

Other Airspace Areas

Other airspace areas, explained in Table 14.1.7-6, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 14.1.7-6: Other Airspace Designations

Type	Definition
Airport Advisory	There are 3 types: Local Airport Advisory – Operated within 10 statute miles of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: Protect people and property from a hazard; Provide safety for disaster relief aircraft during operations; Avoid unsafe aircraft congestion associated with an incident or public interest event; Protect the U.S. President, Vice President, and other public figures; Provide safety for space operations; and 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: (Federal Aviation Administration, 2015d) (Federal Aviation Administration, 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" (Federal Aviation Administration, 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 (Federal Aviation Administration, 2013).

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 sound 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." (Federal Aviation Administration, 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 (Federal Aviation Administration, 2015e).

Vermont Airspace

Aviation regulation and responsibility resides within the Vermont Agency of Transportation (VTrans). The mission is "to support, maintain and enhance the 10 State-owned airports." As the owner/operator of 10 state-owned airports, VTrans promotes efficient and effective operation of its airports to assure safe, secure, and reliable air transportation of goods and people, while being environmentally responsible, cost-effective and supportive of Vermont's economy and recreational activities. Emergency services, aviation education, financial responsibility, and promotion of compatible land use are part of the mission for VTrans, as is playing a supportive role to all airports and aviation statewide" (VTrans, 2015i). There are no FAA Flight Standards District Offices (FSDOs) for Vermont (Federal Aviation Administration, 2015f).

Vermont airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP addresses the strategic planning and future development for the State's airport system, as well as addressing key issues associated with their airports (National Association of State Aviation Officials [NASAO], 2015). Figure 14.1.7-5 presents the different aviation airports/facilities located in Vermont, while Figure 14.1.7-6 and Figure 14.1.7-7 present the breakout by public and private airports respectively. There are approximately 83 airports (public and private) within Vermont as presented in Table 14.1.7-7 and (DOT, 2015c).

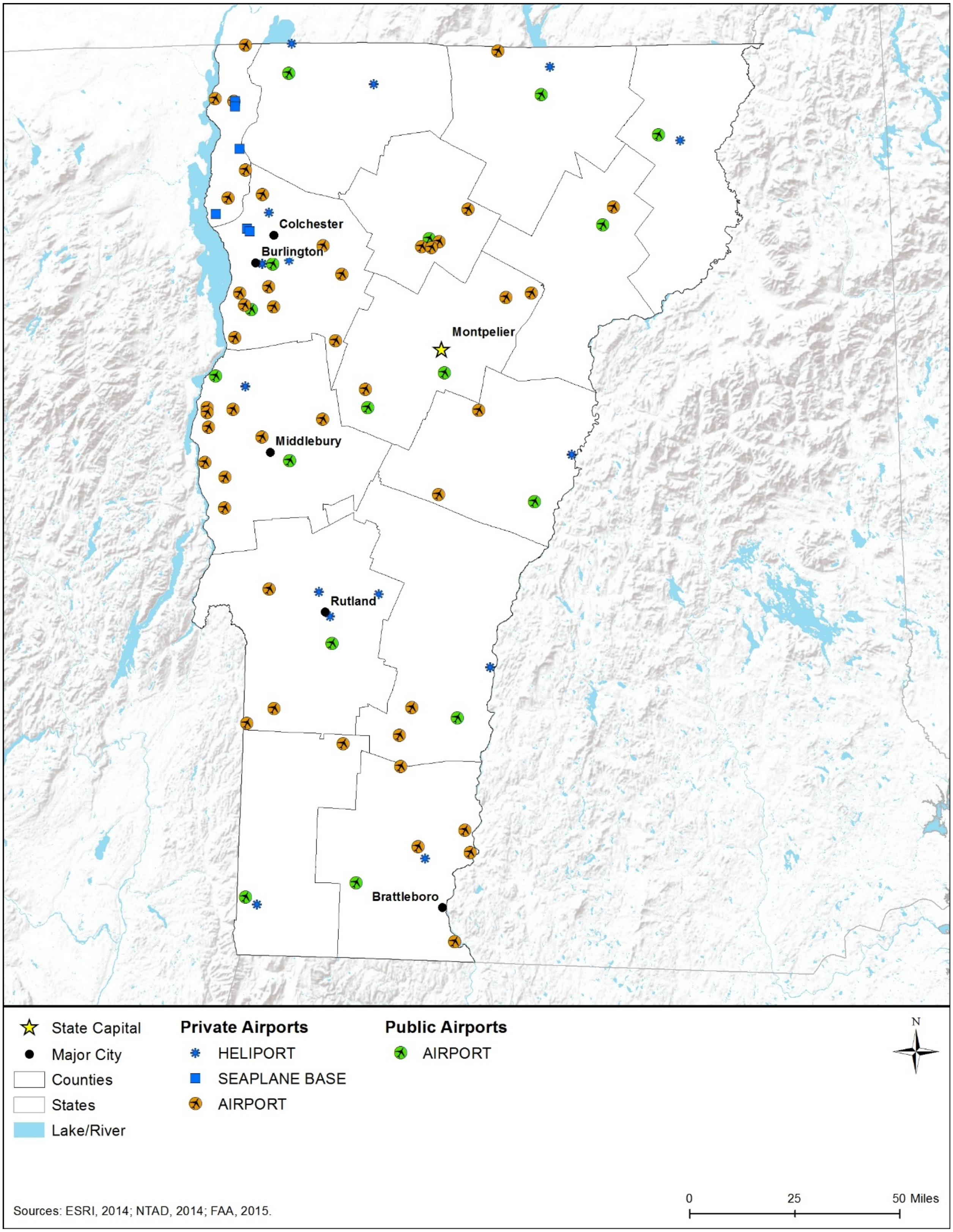

Figure 14.1.7-5: Composite of Vermont Airports/Facilities

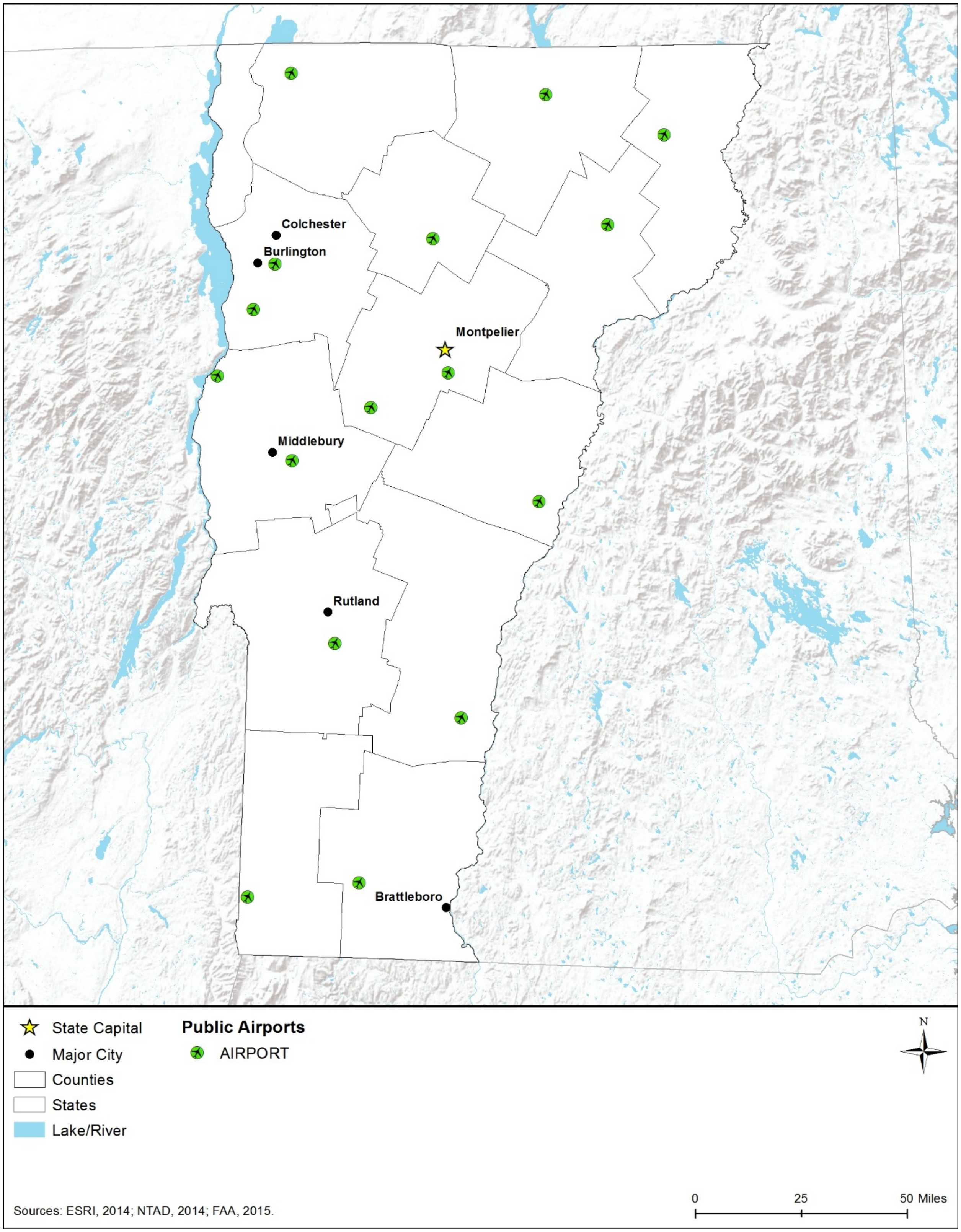

Figure 14.1.7-6: Public Vermont Airports/Facilities

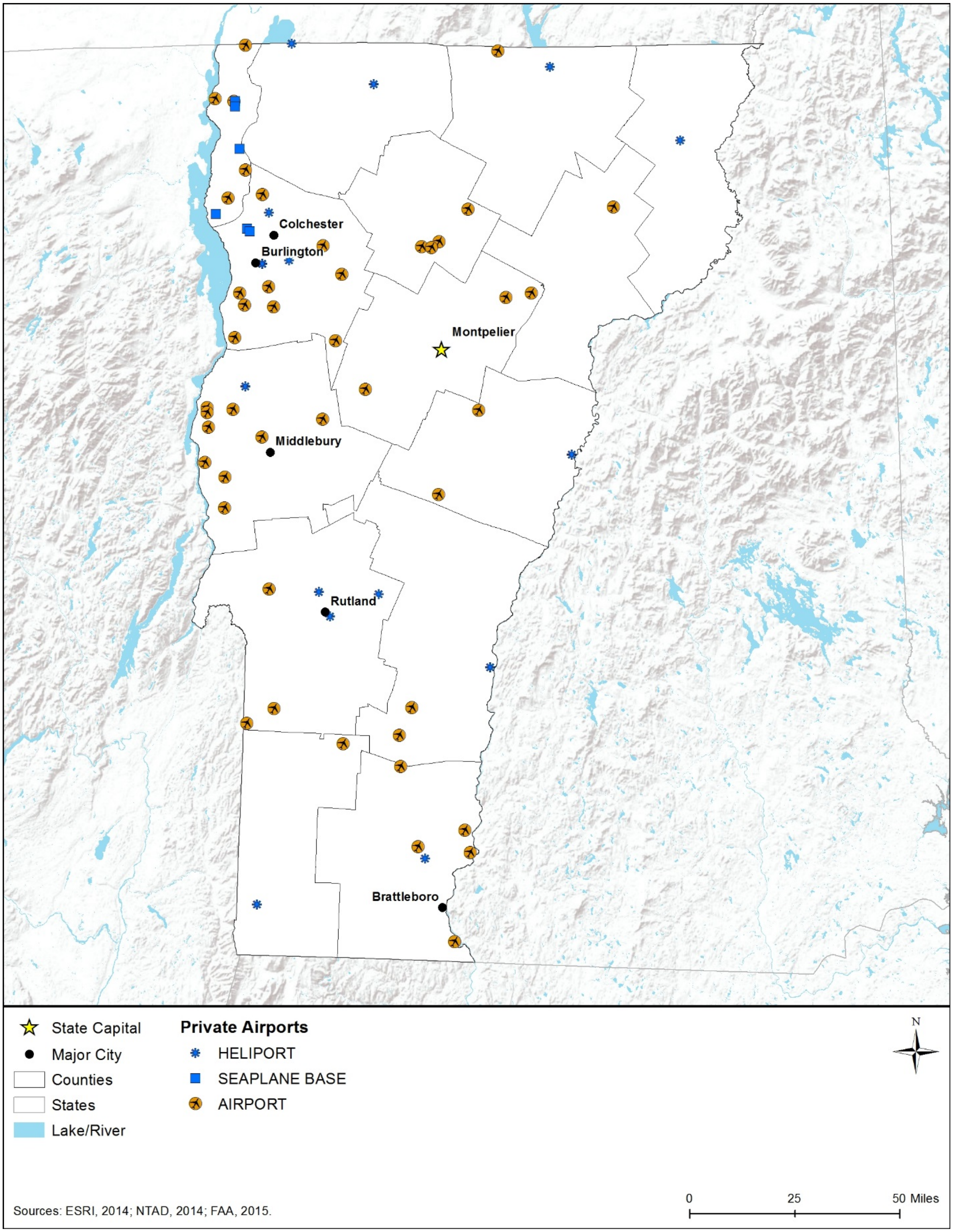

Figure 14.1.7-7: Private Vermont Airports/Facilities

Table 14.1.7-7: Type and Number of Vermont Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	16	45
Heliport	0	16
Seaplane	0	6
Ultralight	0	0
Balloonport	0	0
Gliderport	0	0
Total	**16**	**67**

Source: (DOT, 2015d)

There is one Class C controlled airport for the State of Vermont – Burlington International Airport (Federal Aviation Administration, 2014b). SUAs (i.e., restricted) located in Vermont are as follows:

- Underhill (Restricted)
  - R-6501A Surface to 4,000 feet MSL
  - R-6501B 4,000 feet MSL to 13,600 MSL (Federal Aviation Administration, 2015g)

The MOA, Yankee 1, in the State of New Hampshire extends into the eastern portion of Vermont. There are no TFRs (Federal Aviation Administration, 2015h). presents the SUAs in Vermont. MTRs in Vermont, presented in , consist of two Visual Routes 1800 and 1801, two Instrument Routes 800 and 801, and one Slow Route 900.

UAS Considerations

The National Park Service (NPS) signed a policy memorandum on June 24, 2014 that “directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service” (National Park Service, 2014a). There is one national park (Marsh-Billings-Rockefeller National Historical Park) and one unit (the Appalachian Trail) within the State of Vermont that have to comply with this agency directive-(National Park Service, 2015c).

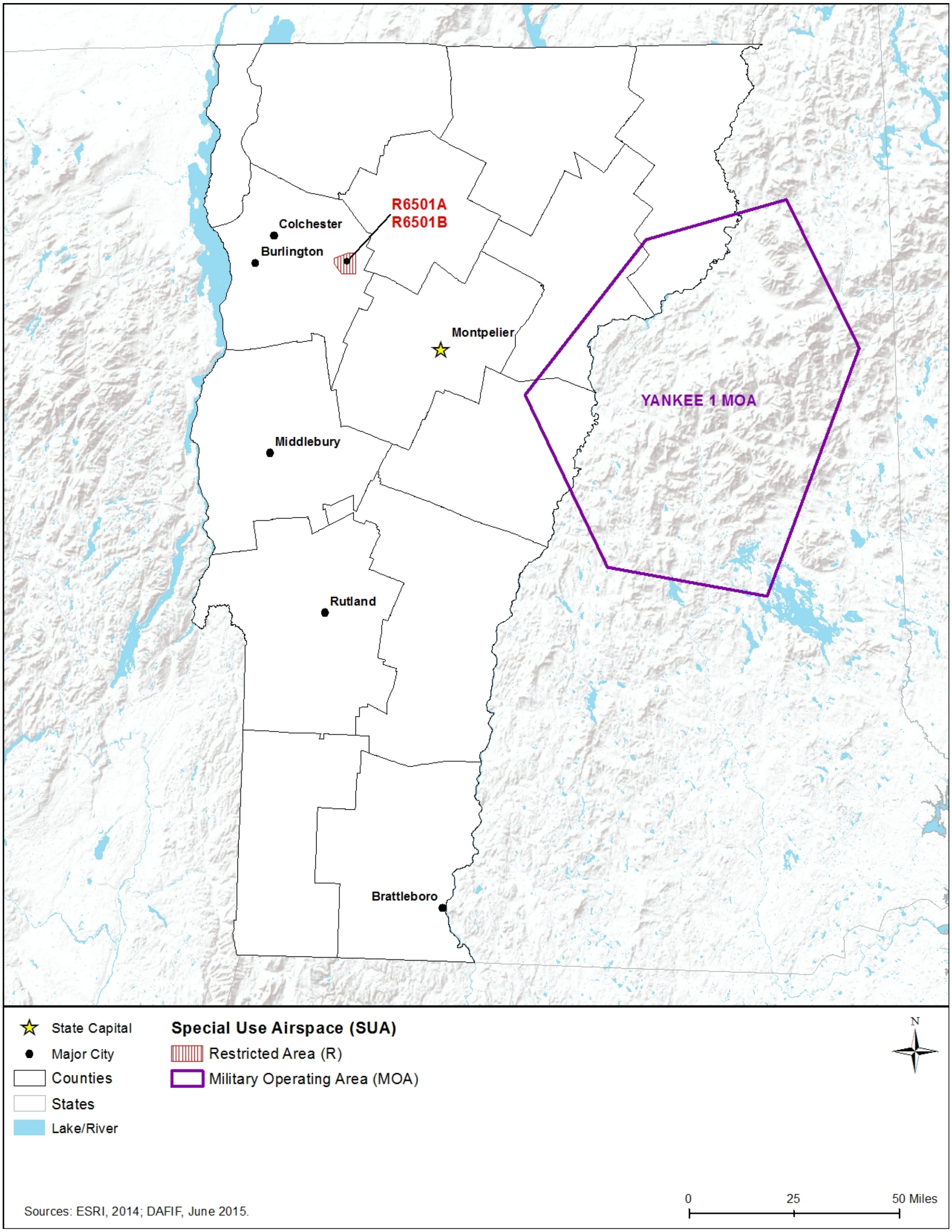

Figure 14.1.7-8: SUAs in Vermont

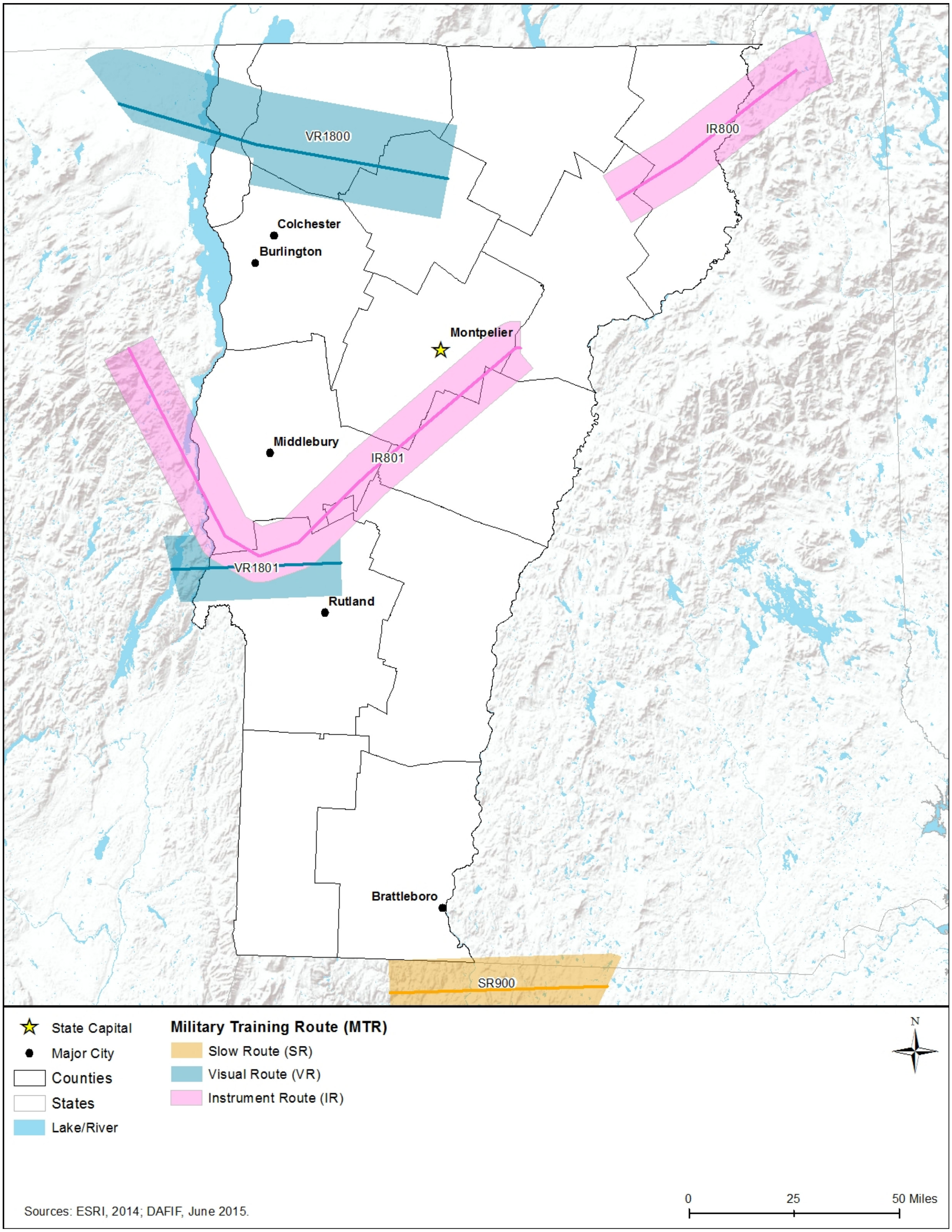

Figure 14.1.7-9: MTRs in Vermont

14.1.8. Visual Resources

14.1.8.1. 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. They are the visible physical features of a landscape and may include mountain ranges, city skylines, ocean views, unique geological formations, rivers, and constructed landmarks such as bridges, memorials, cultural resources, or statues. For some, cityscapes are valued visual resources, whereas others prefer natural areas. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for NEPA and NHPA compliance. The flow of the landscape and the lack of interruptions or obstructions within vistas should be considered. 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)" (Bureau of Land Management, 1984).

One aspect of importance for visual resources is to maintain the character of the area. For example, in a farm community, keeping the character of the town consistent with farm-style houses, barns, and silos would be key in maintaining the character of the community. In a more metropolitan area, there may be many different visual styles within each neighborhood, but keeping the character of the neighborhood is important to maintain if new development were to occur. Section 14.1.7, Land Use, Recreation, and Airspace, discusses land use and contains further descriptions of land cover within the state.

14.1.8.2. Specific Regulatory Considerations

Table 14.1.8-1 presents state laws and regulations that relate to visual resources.

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. Vermont's Act 250 (described above) ensures that all building and development takes into account the 10 criteria[115] specified and "soften the aesthetic impacts of virtually every project," allowing the state to retain "its unsurpassed scenic qualities." (Natural Resources Board, 2006)

Table 14.1.8-1: Relevant Vermont Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Vermont Historic Preservation Act of 1975, 22 VSA Chapter 14	Division for Historic Preservation	Authorizes a State Register of properties as "part of a program to coordinate and support public and private efforts to identify, evaluate and protect Vermont's historic and archaeological resources."

[115] See http://www.nrb.state.vt.us/lup/publications/nrb1.pdf

State Law/Regulation	Regulatory Agency	Applicability
Vermont Land Use and Development Law, Act 250	Natural Resources Board (NRB)	Created nine District Environmental Commissions to minimize the environmental impacts of development by requiring that projects comply with 10 criteria defined in Act 250; established the Vermont Environmental Board to review appeals to the Commissions' rulings (now, the Natural Resources Board).
Vermont Title 10: Conservation and Development, Chapter 15: Vermont Housing and Conservation Trust Fund	Vermont Housing and Conservation Board	Created the Vermont Housing and Conservation Trust Fund to "[conserve] and [protect] Vermont's agricultural land, forestland, historic properties, important natural areas and recreational lands."
Vermont Title 10: Conservation and Development, Chapter 20: Vermont Trails System	Agency of Natural Resources (ANR)	Establishes the Vermont Trails System to "conserve and use the natural resources of [the] state for healthful and recreational purposes" and assigns responsibilities for the system to the ANR.
Vermont Title 10: Conservation and Development, Chapter 83: Department of Forests, Parks and Recreation	Department of Forests, Parks and Recreation (FPR)	Establishes the FPR to "maintain, conserve and improve its soil resources and to control forest pests to the end that forest benefits… are preserved for its people, floods and soil erosion are alleviated, hazards of forest fires are lessened, its natural beauty is preserved, its wildlife is protected, the development of its recreational interests is encouraged"
Vermont Title 10: Conservation and Development, Chapter 37: Wetlands Protection and Water Resources Management	Department of Environmental Conservation (DEC)	Establishes the DEC to "protect and manage the water resources of the State."
Vermont Title 10: Conservation and Development, Chapter 103: Department of Fish and Wildlife	Department of Fish and Wildlife (DFW)	Establishes the DFW for "[t]he protection, propagation control, management, and conservation of fish, wildlife, and fur-bearing animals" in Vermont for "the interest of the public welfare."
Vermont Wetland Rules, Vermont Code R. 12 004 056	ANR	Identifies and protects the "functions and values of significant wetlands."

14.1.8.3. Character and Visual Quality of the Existing Landscape

Vermont's landscape is characterized by mountains, lakes, and rivers (Vermont Department of Forests, Parks and Recreation, 2014). The state is partially bordered on the west by Lake Champlain and on the east by the Connecticut River. The Green Mountains run the entire length of the state from south to north, earning Vermont the nickname, "The Green Mountain State." The visual resources of the state include mountain ranges, dense forests, waterfalls, wetlands, wildlife, and flora. (Vermont Agency of Natural Resources, 2015a)

While the state and many municipalities have some regulation of scenic and visual resources, not all scenic areas within the state have been identified or have policy or regulations for management or protection by the state. The areas listed below have some measure of management, significance, or protection through state or federal policy, as well as being identified as a visually significant area.

14.1.8.4. 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. In Vermont, there are 836 National Register of Historic Places (NRHP) listed sites, which include 1 National Heritage Area, 18 National Historic Landmarks, and 1 National Historical Park (National Park Service, 2015d). Some State Historic Sites and State Heritage Areas may also be included in the NRHP, whereas others are not designated at this time. Figure 14.1.8-1 shows areas that are included in the National Register of Historic Places that may be considered visually sensitive. See Section 14.1.11, Cultural Resources, for more information.

The National Park Service is required to protect all aspects of historic landscapes considered significant, such as forests, gardens, trails, structures, ponds, and farming areas using *The Secretary of the Interior's Standards for the Treatment of Historic Properties and the Guidelines for the Treatment of Cultural Landscapes* (National Park Service, 2015e). 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 (National Park Service, 2015e).

National Heritage Areas

National Heritage Areas (NHAs) are "places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape" (National Park Service, 2015f). These areas help tell the history of the United States. Vermont shares an NHA with New York, the Champlain Valley National Heritage Partnership (see Figure 14.1.8-1). The Champlain Valley National Heritage Partnership includes "navigable waterways and adjacent lands of Lake Champlain, Lake George, the Champlain Canal, and portions of the Upper Hudson River." The region was home to Native Americans of the Algonquin and Iroquois tribes and was the route of "exploration, military campaigns, and maritime commerce." (National Park Service, 2015g).

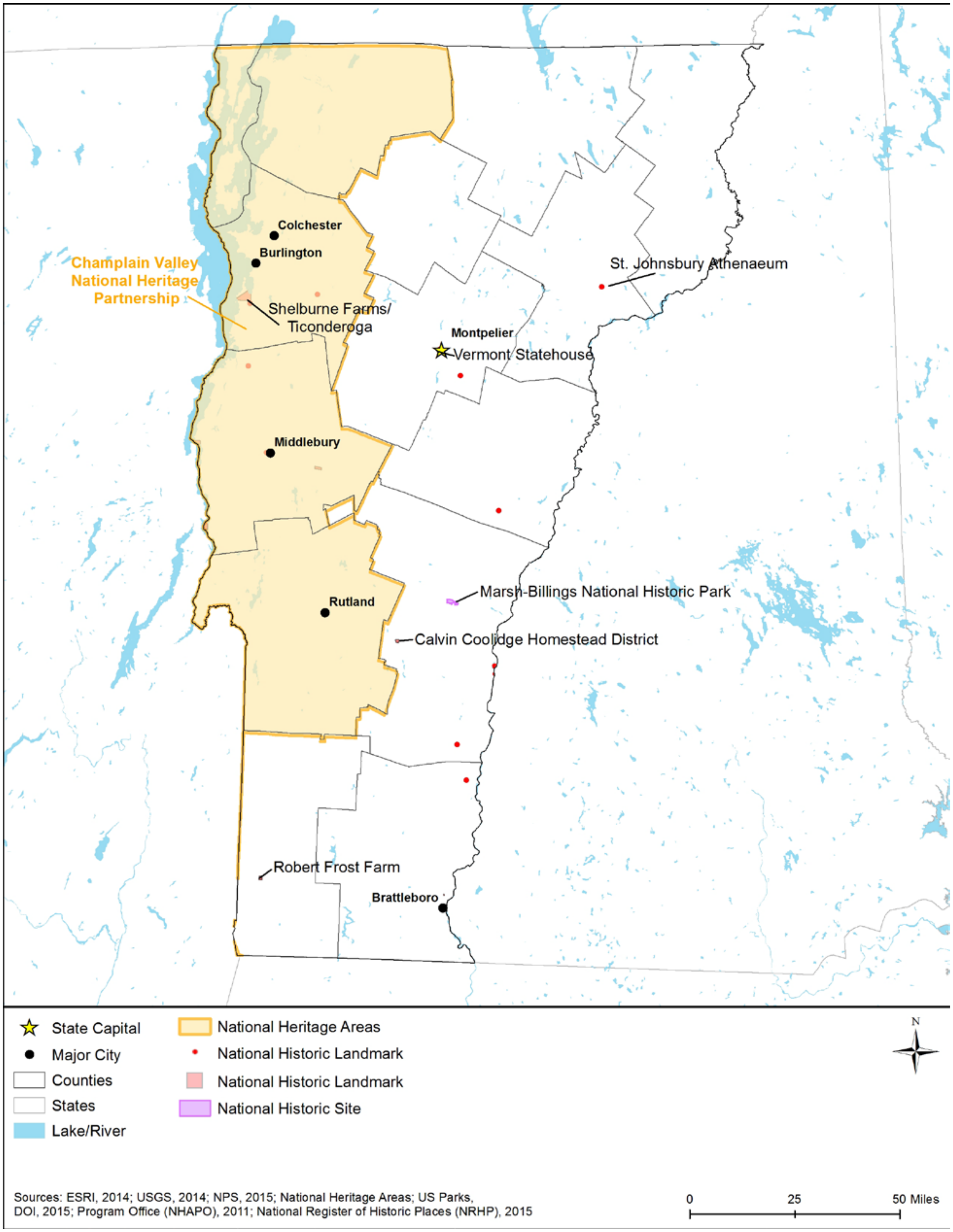

Figure 14.1.8-1: Vermont Cultural and Heritage Resources that May be Visually Sensitive

Table 14.1.8-2: Vermont National Historic Landmarks

Vermont National Historic Landmarks	
Brown Bridge	Rokeby
Calvin Coolidge Homestead District	Round Church
Robert Frost Farm	Shelburne Farms
George Perkins Marsh Boyhood Home	Socialist Labor Party Hall
Justin S. Morrill Homestead	St. Johnsbury Athenaeum
Mount Independence	Stellafane Observatory
Naulakha (Rudyard Kipling House)	Ticonderoga
Rockingham Meeting House	Vermont Statehouse
Robbins and Lawrence Armory and Machine Shop	Emma Willard House

Source: (National Park Service, 2015h)

State Historic Sites and Parks

The Vermont Division for Historic Preservation maintains a State Register of "thousands of historic districts, sites, buildings, structures and objects throughout" the state (Vermont Agency of Commerce & Community Development, 2015). Of these, the state maintains eight museums and parks with hiking trails and photographic opportunities under its purview. These State Historic Sites and Parks include Bennington Battle Monument State Historic Site, President Calvin Coolidge State Historic Site, Chimney Point State Historic Site, Hubbardton Battlefield State Historic Site, Mount Independence State Historic Site, Old Constitution House State Historic Site, Morrill Homestead State Historic Site, and President Chester Arthur State Historic Site. (State of Vermont, 2015b)

14.1.8.5. Parks and Recreation Areas

Parks and recreation areas include State Parks, National Recreation Areas, National Scenic and Recreational Rivers, State Scenic and Recreational Rivers, State Forests, and National and State Trails. Parks and recreation areas often contain scenic resources and tend to be visited partly because of their associated visual or aesthetic qualities. Figure 14.1.7-3 in Section 14.1.7, Land Use, Recreation, and Airspace, identifies parks and recreational resources that may be visually sensitive in Vermont. Figure 14.1.8-3 displays natural areas that may be visually sensitive, including park and recreation areas.

State Parks and Forests

State parks contain natural, historic, cultural, and/or recreational resources of significance to Vermont residents and visitors. There are 54 state parks throughout Vermont, most of which likely contain scenic or aesthetic areas considered to be visual resources or visually sensitive (Vermont Department of Forests, Parks and Recreation, 2015b). Table 14.1.8-2 contains a list of several of the best known state parks visited for their views and their associated visual attributes (Vermont Department of Forests, Parks and Recreation, 2009a) (See Figure 14.1.8-3). A complete list of state parks can be found at http://www.vtstateparks.com/htm/map.htm.

Table 14.1.8-3: Examples of Vermont State Parks and Associated Visual Attributes

State Park	Visual Attributes
Coolidge State Park	Rustic hillsides, Green Mountain views, Black River valley views, hiking trails, state forest land
Mt. Philo State Park	Views of Lake Champlain Valley, Adirondack Mountain views, Lake Champlain, open grassy area, state forest land
Kill Kare State Park	Lake Champlain, wooded island views, green hills, Adirondack Mountain views, Mosquito and Burton Island views, shady, green lawn, flower gardens
New Discovery State Park	State forest land, northern bog and wetland views, view of Owl's Head promontory, hills, valleys, lakes, wildlife
Kingsland Bay State Park	Lake Champlain, large lawns, natural trail, creek

Source: (Vermont Department of Forests, Parks and Recreation, 2009a)

In addition to state parks, Vermont also has 38 state forests. These forests are diverse due to the state's position in the "biological transition zone between the northern boreal forests [and] the southern deciduous forests" with a "mix of beech, birch, and maple" tree (Vermont Department of Forests, Parks and Recreation, 2015c). An example of these dense forests is Boyer State Forest (Figure 14.1.8-2). Table 14.1.8-4 identifies Vermont's State Forests, a few of which are presented in Figure 14.1.8-3.

Table 14.1.8-4: Vermont State Forests

State Forest Name	
Aitken State Forest	Lyndon State Forest
Arlington State Forest	Mathewson State Forest
Black Turn Brook State Forest	Mollie Beattie State Forest
Boyer State Forest	Mt. Carmel State Forest
Cambridge State Forest	Mt. Cushman State Forest
Camels Hump State Forest	Mt. Mansfield State Forest
CC Putnam State Forest	Okemo State Forest
Coolidge State Forest	Proctor-Piper State Forest
Dorand State Forest	Roxbury State Forest
Downer State Forest	Rupert State Forest
Essex Nursery	Thetford Hill State Forest
Granville Gulf Reservation	Townshend State Forest
Groton State Forest	Victory State Forest
Hapgood State Forest	Washington State Forest
Jay State Forest	WC Putnam State Forest
Long Trail State Forest	West Rutland State Forest
Lord State Forest	Williams River State Forest
Lower Clarendon Gorge	Willoughby State Forest
LR Jones State Forest	Woodchuck Mountain

Source: (Vermont Department of Forests, Parks and Recreation, 2015d)

Figure 14.1.8-2: Boyer State Forest

Source: (Vermont Department of Forests, Parks and Recreation, 2015e)

U.S. National Park System and National Forests

NPS and U.S. Department of Agriculture (USDA) National Forests contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation. Owned by the U.S. government, these areas are maintained for the public's use.

National Historical Park

Vermont has one National Historical Park, Marsh – Billings – Rockefeller (Figure 14.1.8-4), which is preserved by the NPS to "commemorate persons, events, and activities important in the nation's history." (National Park Service, 2003) (National Park Service, 2015b). It is the "only national park to tell the story of conservation history and the evolving nature of land stewardship in America" (National Park Service, 2015i). This park contains aesthetic and scenic values associated with history. There is also one National Forest, the Green Mountain National Forest, covering more than 400,000 acres including 10 ski areas and 900 miles of multi-use trails (National Park Service, 2015b).

Table 14.1.8-5 identifies the National Park System units located in Vermont and Figure 14.1.8-3 displays them on the map. For additional information regarding parks and recreation areas, see Section 14.1.7, Land Use, Recreation, and Airspace.

Table 14.1.8-5: Vermont National Park Service Areas

NPS Area Name	
Appalachian Trail	Marsh – Billings - Rockefeller

Source: (National Park Service, 2015b)

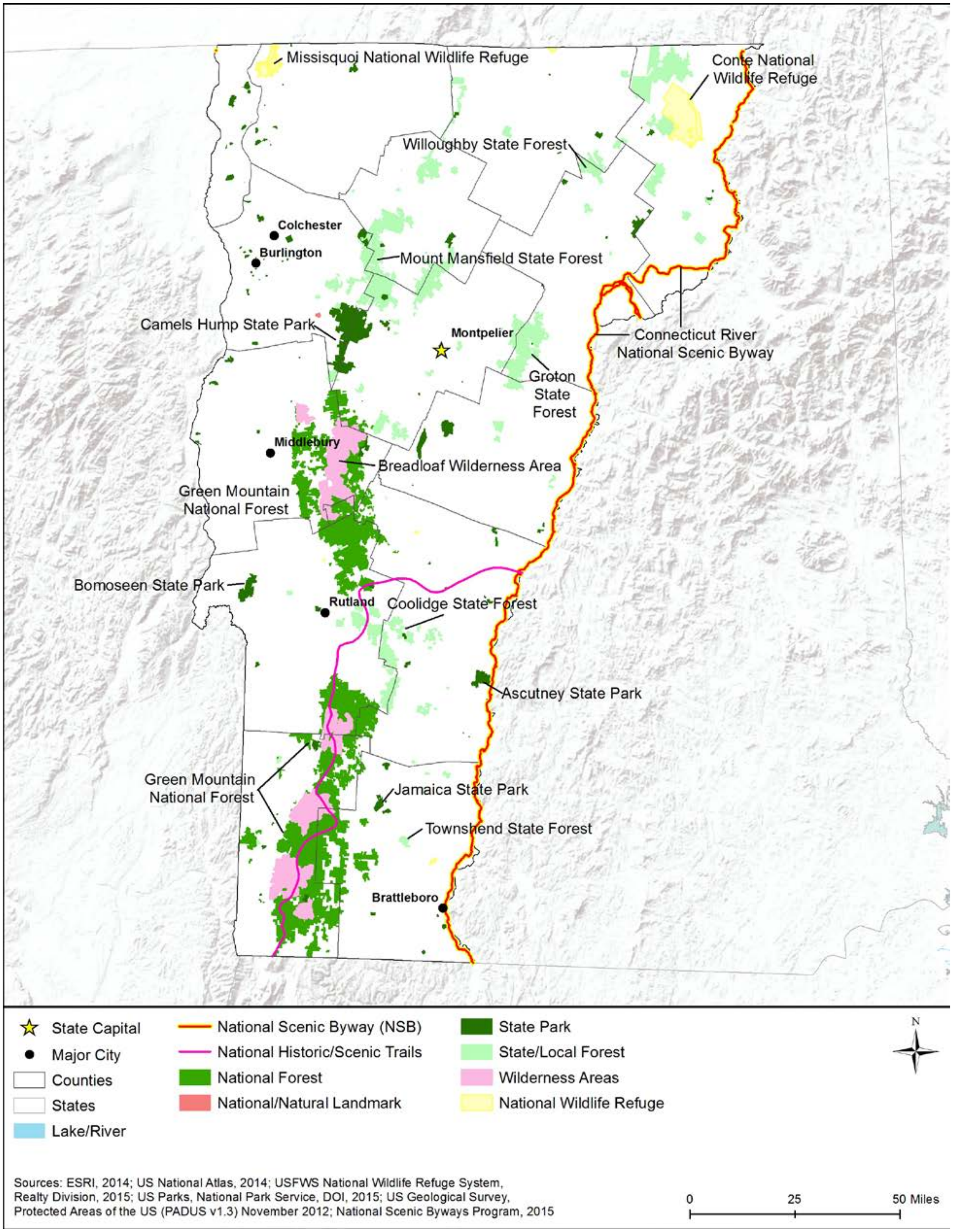

Figure 14.1.8-3: Natural Areas that May be Visually Sensitive

Figure 14.1.8-4: Marsh-Billings-Rockefeller National Historical Park

Source: (National Park Service, 2015j)

State and Federal Trails

Vermont boasts numerous trails for nature walking, hiking, skiing and other recreation in the state forests and parks. These are designated for parks and recreation use, and there is no separate designation as scenic or historical, although all have aesthetic value and some have an accompanying historical value as well. The Vermont Department of Forests, Parks, and Recreation maintains a list of trail information (Vermont Department of Forests, Parks and Recreation, 2009b).

Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Scenic Trails (NSTs) are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass" (National Park Service, 2012a). The only National Scenic Trail in Vermont is the Appalachian NST administered by the NPS (see Figure 14.1.8-3). The Appalachian NST is a 2,185-mile trail through the Appalachian Mountains traversing 14 states (National Park Service, 2015k).

In addition to National Scenic Trails, the National Trails System Act authorized the designation of National Recreational Trails near urban areas by either the Secretaries of the Interior or Agriculture, depending upon the ownership of the designated land (American Trails, 2015). In Vermont there are two National Recreation Trails administered by the USFS, the Long National

Recreation Trail and the Robert Frost National Recreational Trail, both of which are contained within Green Mountain National Forest (USFS, 2015c).

National Recreation Areas

There are two national recreation areas within the Green Mountain National Forest administered by the USFS, the Moosalamoo National Recreation Area and Robert T. Stafford White Rocks National Recreation Area (Vermont Department of Forests, Parks and Recreation, 2014). Moosalamoo includes over 15,000 acres of scenic mountain vistas, forests, and waterfalls for camping, hiking, biking, and nature watching including the Robert Frost Trail (USFS, 2015d). The Robert T. Stafford White Rocks recreation area is popular hiking area in the Green Mountain National Forest (National Park Service, 2015l).

14.1.8.6. Natural Areas

National Wilderness Areas

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

Vermont is home to seven federally managed Wilderness Areas. All are located in various parts of the Green Mountain National Forest and include Bristol Cliffs Wilderness, Breadloaf Wilderness, Big Branch Wilderness, Peru Peak Wilderness, Lye Brook Wilderness, Glastenbury Wilderness, and George D. Aiken Wilderness (National Park Service, 2015m).

State Forest Preserves and Conservation Areas

The Vermont Agency of Natural Resources (ANR) “manages state-owned land for a variety of purposes, ranging from the protection of important natural resources to public uses of land.” The ANR divides state lands by district and manages each using an approved management plan. These areas are contained with the national and state parks and wildlife management areas and refuges. Specific information related to each of the areas is available at Vermont’s Agency of Natural Resources’ Department of Forests, Parks and Recreation, State Lands Administration, Planning Documents site (Vermont Department of Forests, Parks and Recreation, 2015a).

Rivers Designated as National Wild, Scenic or Recreational

National Wild, Scenic, or Recreational Rivers are those rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C.

1271-1287). These rivers have outstanding natural, cultural, and recreational values, including potential visual resources. Vermont has two designated national wild and scenic rivers, the Missisquoi River (Figure 14.1.8-5) and Trout River, with a combined 46.1 miles of recreational areas including beaches and three swimming holes and visual interests, such as waterfalls and a gorge (National Wild and Scenic Rivers System, 2015c). The state does not classify its own separate wild, scenic or recreation rivers.

Figure 14.1.8-5: Missisquoi River

Source: (DEC, 2015w)

14.1.8.7. National Wildlife Refuges and State Wildlife Management Areas

National Wildlife Refuges (NWRs) are a network of lands and waters managed by the USFWS. These lands and waters are "set aside for the conservation, management and, where appropriate, restoration of fish, wildlife, and plant resources and their habitats" (USFWS, 2015m). There is one NWR wholly in Vermont: Missisquoi National Wildlife Refuge (see Figure 14.1.8-3). The refuge is comprise of approximately 6,729 acres of wetland habitat and supports migratory birds and other wildlife (USFWS, 2014f). Visual resources within the NWR include open fields, hardwood forests, natural marsh, and wooded swamps (USFWS, 2013b). The Silvio O. Conte National Fish and Wildlife Refuge resides in part in Vermont, as well as Connecticut, Massachusetts and New Hampshire. This refuge contains 36,000 acres of Connecticut River watershed, 26,600 of which is in Vermont. This area is rife with visual resources such as conifer and deciduous forest, forested wetlands, and wildlife. It is also is home to a large population of songbirds and is designated by the National Audubon Society as an Important Bird Area (USFWS, 2014d).

The Vermont Fish and Wildlife Department manages the plant and animal species inhabiting 133,000 acres on 89 Wildlife Management Areas in the state (Vermont Fish and Wildlife Department, 2015f). For additional information on wildlife refuges and management areas, see Section 11.7, Wildlife.

National Natural Landmarks

National Natural Landmarks (NNLs) are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (National Park Service, 2014b). These landmarks may be considered visual resources or visually sensitive. In Vermont, 12 NNLs exist entirely or partially within the state (see Table 14.1.8-6) (see Figure 14.1.8-3). Some of the natural features located within these areas include the large freshwater marsh (Barton River Marsh, Figure 14.11.3-6), a fossil reef, a deep lake, and red spruce balsam forest (National Park Service, 2012b).

Figure 14.1.8-6: Barton River Marsh

Source: (National Park Service, 2012c)

Table 14.1.8-6: Vermont National Natural Landmarks

NNL Name	
Battell Biological Preserve	Fisher-Scott Memorial Pines
Barton River Marsh	Gifford Woods
Camel's Hump	Lake Willoughby Natural Area
Chazy Fossil Reef	Little Otter Creek Marsh
Cornwall Swamp	Mount Mansfield Natural Area
Franklin Bog	Molly Bog

Source: (National Park Service, 2012b)

14.1.8.8. Additional Areas

State and National Scenic Byways

National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. Vermont has one designated National Scenic Byway: the Connecticut River Byway, which connects the east and west coasts of the Connecticut River and traverses both Vermont and New Hampshire (see Figure 14.1.7-7 in Section 14.1.7 Land Use, Recreation, and Airspace) (Vermont Byways Program, 2015a).

Similar to National Scenic Byways, the Vermont Byways Program is administered by the Vermont Department of Tourism and Marketing (VDTM). There are 10 State Byways (see Figure 14.1.7-1 in Section 14.1.7, Land Use, Recreation, and Airspace, and Table 14.1.7-7), including the Connecticut River Byway, which is both a designated National Scenic Byway and a State Scenic Byway (see Table 14.1.8-7).

Table 14.1.8-7: Vermont Scenic Byways

Byway Name	
Connecticut River National Byway	Molly Stark Byway
Crossroad of Vermont Byway	Northeast Kingdom Byway
Green Mountain Byway	Scenic Route 100 Byway
Lake Champlain Byway	Shires of Vermont Byway
Mad River Byway	Stone Valley Byway

Source: (Vermont Byways Program, 2015b)

14.1.9. Socioeconomics

14.1.9.1. Definition of the Resource

NEPA requires consideration of socioeconomics in NEPA analysis; specifically, Section 102(A) of NEPA requires federal agencies to “insure the integrated use of the natural and social sciences…in planning and in decision making” (42 U.S.C. 4332(A)). Socioeconomics refers to a broad, social science-based approach to understanding a region’s social and economic conditions. It typically includes population, demographic descriptors, economic activity indicators, housing characteristics, property values, and public revenues and expenditures. When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of FirstNet projects, as those projects may affect the socioeconomic conditions of a region.

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

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

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898 (see

Section 1.8). This PEIS addresses environmental justice in a separate section (Section 14.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: Land Use, Recreation, and Airspace (Section 14.1.7), infrastructure and public services (Section 14.1.1, Infrastructure), and aesthetic considerations (Section 14.1.8, Visual Resources).

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

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau (Census Bureau) and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this PEIS. In all cases, this section uses the most recent data available 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.

14.1.9.2. 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.

14.1.9.3. Communities and Populations

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

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

Statewide Population and Population Growth

Table 14.1.9-1 presents the 2014 population and population density of Vermont in comparison to the East region[116] and the nation. The estimated population of Vermont in 2014 was 626,562. The population density was 68 persons per square mile (sq. mi.), which is significantly lower than the population density of both the region (312 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Vermont was the second smallest state by population among the 50 states and the District of Columbia, 43rd largest by land area, and had the 32nd greatest population density (U.S. Census Bureau, 2015aa; U.S. Census Bureau, 2015e).

Table 14.1.9-1: Land Area, Population, and Population Density of Vermont

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Vermont	9,217	626,562	68
East Region	237,157	73,899,862	312
United States	3,531,905	318,857,056	90

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

Population growth is an important aspect for this PEIS given FirstNet's mission. Table 14.1.9-2 presents the population growth trends of Vermont from 2000 to 2014 in comparison to the East region and the nation. The state's annual growth rate declined from 0.27 percent in the 2000 to 2010 period to 0.03 percent in the 2010 to 2014 period. Both the region and nation showed higher growth rates in both periods compared to the Vermont.

Table 14.1.9-2: Recent Population Growth of Vermont

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
Vermont	608,827	625,741	626,562	16,914	821	0.27%	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%

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

Demographers prepare future population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore, Table 14.1.9-3 presents

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

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 Vermont's population will increase by approximately 40,251people, or 6.4 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.39 percent, which is higher than the historical growth rates in both periods, 2000 to 2010 (0.27 percent) and 2010 to 2014 (0.03 percent), as presented in Table 14.1.9-2. The projected growth rate of the state is slightly lower than that of the region (0.57 percent) and half the projected growth rate of the nation (0.80 percent).

Table 14.1.9-3: Projected Population Growth of Vermont

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
Vermont	626,562	696,975	636,650	666,813	40,251	6.4%	0.39%
East Region	73,899,862	78,925,282	82,842,294	80,883,788	6,983,926	9.5%	0.57%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.6%	0.80%

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

Population Distribution and Communities

Figure 14.1.9-1 presents the distribution and relative density of the population of Vermont. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density – therefore, areas that are solid in color are particularly high in population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 2015f).

This map also presents the 10 largest population concentrations in the state, outlined in purple. These population concentrations reflect contiguous, densely developed areas as defined by the Census Bureau based on the 2010 census (U.S. Census Bureau, 2015g; 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 14.1.9-4 provides the populations of the 10 largest population concentrations in Vermont, based on the 2010 census. It also shows the changes in population for these areas between the

2000 and 2010 censuses.[117] In 2010, the largest population concentration was the Burlington area, which had 108,740 people. The state had no other population concentrations over 100,000. The second largest population concentration in 2010 was in the Barre/Montpelier area with 21,675 people. The smallest of these 10 population concentrations was the St. Johnsbury area, with a 2010 population of 5,073. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Vermont portion of Brattleboro area, with an annual growth rate of 1.17 percent. The only other area with a growth rate over 1.00 percent was the Middlebury area (1.12 percent). Five of these areas experienced population declines during this period (see Table 14.1.9-4).

Table 14.1.9-4 also shows that the top 10 population concentrations in Vermont accounted for over 33 percent of the state's population in 2010. This figure indicates that much of Vermont's population is dispersed outside of the 10 largest population concentrations. Further, population growth in the 10 areas from 2000 to 2010 amounted to 69.0 percent of the entire state's growth. These areas grew at a faster rate, 0.58 percent, than the state as a whole, 0.27 percent.

Table 14.1.9-4: Population of the 10 Largest Population Concentrations in Vermont

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Barre/Montpelier	22,022	21,675	21,140	2	(347)	-0.16%
Bennington	13,220	12,723	12,207	4	(497)	-0.38%
Brattleboro (VT/NH) (VT Portion)	8,877	9,971	9,764	5	1,094	1.17%
Burlington	105,365	108,740	109,685	1	3,375	0.32%
Lebanon/Hanover (NH/VT) (VT Portion)	6,319	6,287	6,279	8	(32)	-0.05%
Middlebury	4,786	5,350	5,238	9	564	1.12%
Milton*	NA	8,521	8,146	7	NA	NA
Rutland	20,501	19,840	19,472	3	(661)	-0.33%
St. Albans	9,762	9,054	9,035	6	(708)	-0.75%
St. Johnsbury	4,703	5,073	4,442	10	370	0.76%
Total for Top 10 Population Concentrations	195,555	207,234	205,408	NA	11,679	0.58%
Vermont (statewide)	608,827	625,741	625,904	NA	16,914	0.27%
Top 10 Total as Percentage of State	32.1%	33.1%	32.8%	NA	69.0%	NA

Sources: (U.S. Census Bureau, 2015g; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j)
AARC = Average Annual Rate of Change (compound growth rate)
*The Census Bureau did not define a "Milton" urban area in 2000.

[117] 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.

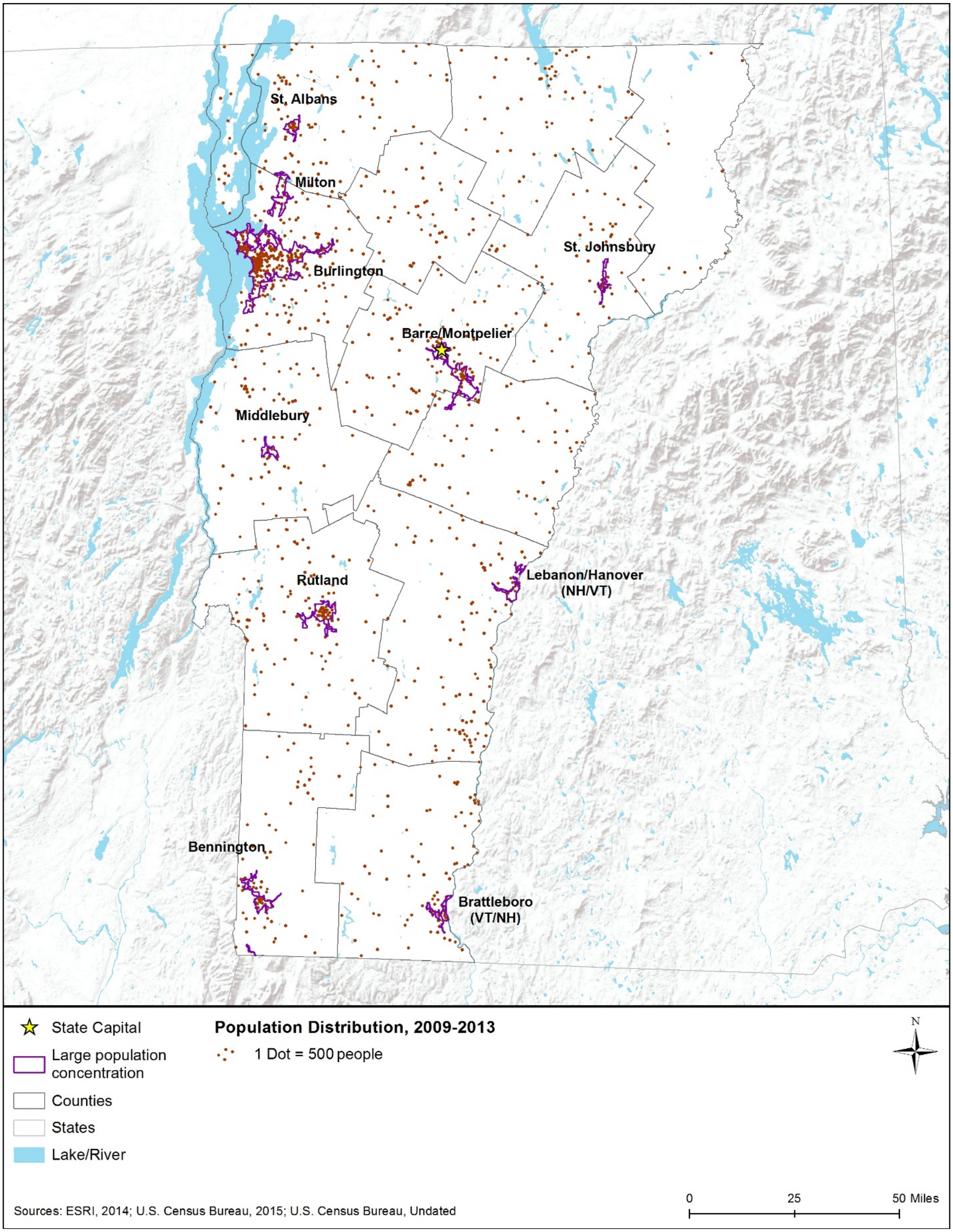

Figure 14.1.9-1: Population Distribution in Vermont, 2009–2013

14.1.9.4. Economic Activity, Housing, Property Values, and Government Revenues

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

- Economic activity
- Housing
- Property values, and
- Government revenues

Social institutions – educational, family, political, public service, military, and religious – are present throughout the state. The institutions most relevant to FirstNet projects are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 14.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 14.1.9-5 compares several economic indicators for Vermont to the East region and the nation. The table presents two indicators of income[118] – 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 14.1.9-5, the per capita income in Vermont in 2013 ($29,136) was $3,716 lower than that of the region ($32,852), and $952 higher than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 14.1.9-5 shows that in 2013, the MHI in Vermont ($52,511) was $7,993 lower than that of the region ($60,504), and $261 higher than that of the nation ($52,250).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the unemployment rate as the number of unemployed individuals who are looking for work divided by the total number of individuals in the labor force. Table 14.1.9-5 compares the

[118] 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, 2015k)

unemployment rate in Vermont to the East region and the nation. In 2014, Vermont's statewide unemployment rate of 4.1 percent was lower than both the rate for the region (6.0 percent) and the nation (6.2 percent).[119]

Table 14.1.9-5: Selected Economic Indicators for Vermont

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Vermont	$29,136	$52,511	4.1%
East Region	$32,852	$60,504	6.0%
United States	$28,184	$52,250	6.2%

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

Figure 14.1.9-1 and Figure 14.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015l) and unemployment in 2014 (Bureau of Labor Statistics, 2015a) varied by county across the state. These maps also incorporate the same population concentration data as Figure 14.1.9-2 (U.S. Census Bureau, 2015g; U.S. Census Bureau, 2015h). Following these two maps, Figure 14.1.9-3 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 Vermont.

Figure 14.1.9-2 shows that most counties in Vermont had a MHI above the national median, with the exception of two counties located in the northeastern portions of the state. Table 14.1.9-6 shows that MHI in the top 10 population concentrations ranged from $26,898 to $73,387. MHI was highest in the Milton ($73,387) and Burlington ($56,570) areas, where MHI was higher than the state average. MHI in all other population concentrations was below the state average. MHI was lowest in the St. Johnsbury area, which has the smallest population of the areas shown in the table.

Figure 14.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that most counties in Vermont had unemployment rates below the national average (that is, better employment performance), with the exception of two counties in the northeast. When comparing unemployment in the population concentrations to the state average (Table 14.1.9-6), only three areas (Barre/Montpelier, Middlebury, and Milton) had 2009–2013 unemployment rates that were lower than the state average.

Detailed employment data provides useful insights into the nature of a local, state, or national economy. Table 14.1.9-7 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

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

salary workers was slightly lower in Vermont than in the East region and the nation. The percentage of government workers was similar in the state to the region and nation. Self-employed workers were a considerably higher percentage in Vermont compared to the region and nation.

By industry, Vermont has a mixed economic base and some notable figures in the table are as follows. Vermont in 2013 had a notably higher percentage of persons working in "agriculture, forestry, fishing and hunting, and mining" than did the region, and a similar percentage to the nation. Vermont had considerably higher percentages of persons working in "construction" and "manufacturing" than did the region. It also had a considerably higher percentage of workers in "educational services, and health care and social assistance" than the region or nation. On the other hand, Vermont had considerably lower percentages of people working in "professional, scientific, management, administrative, and waste management services," and "finance and insurance, and real estate and rental and leasing" than the region or nation.

Table 14.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Vermont, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Barre/Montpelier	$49,953	6.2%
Bennington	$36,060	11.0%
Brattleboro (VT/NH) (VT Portion)	$41,889	7.7%
Burlington	$56,570	6.9%
Lebanon/Hanover (NH/VT) (VT Portion)	$49,471	7.9%
Middlebury	$43,387	6.0%
Milton	$73,387	5.7%
Rutland	$41,873	10.0%
St. Albans	$47,306	7.0%
St. Johnsbury	$26,898	14.7%
Vermont (statewide)	$54,267	6.8%

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

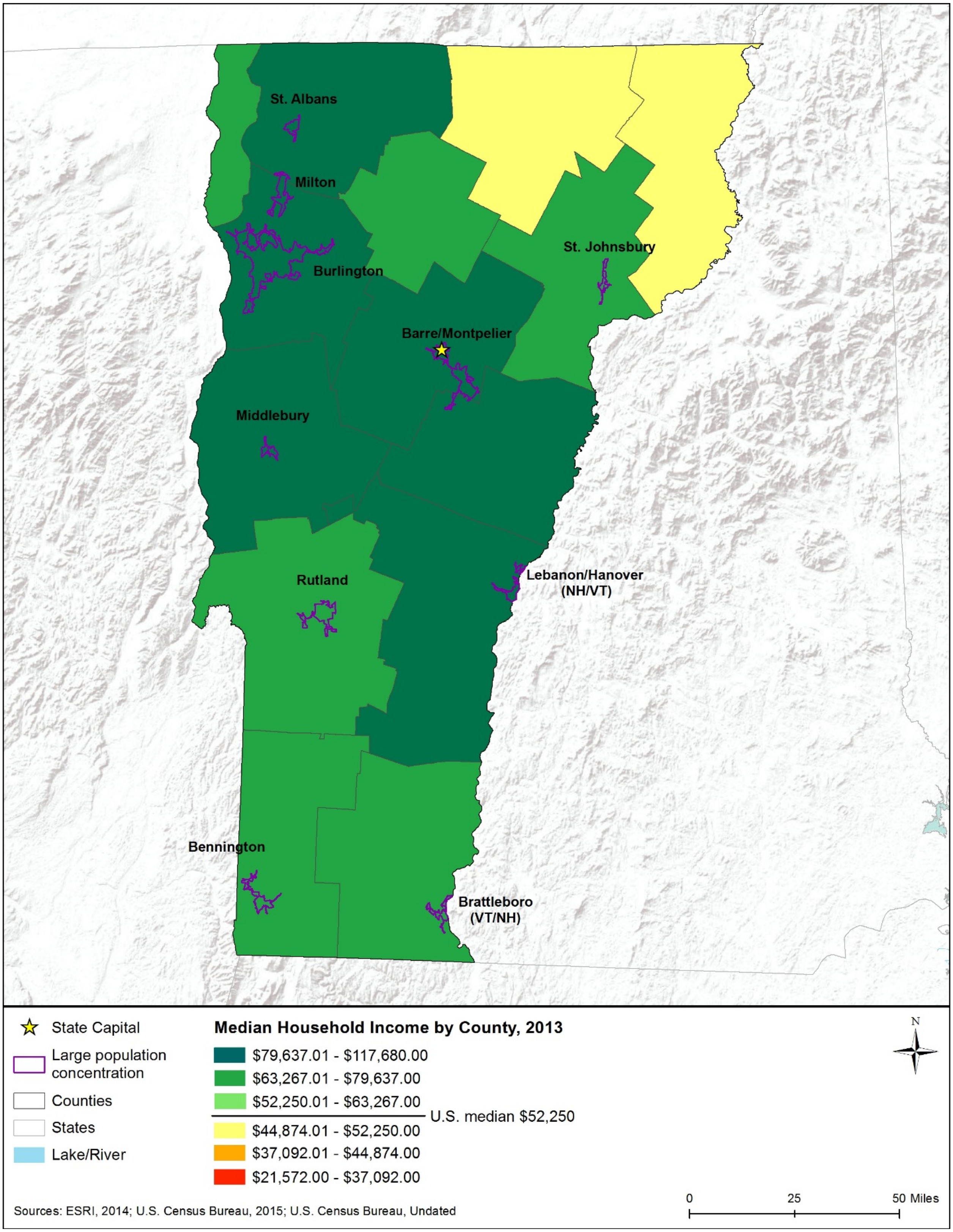

Figure 14.1.9-2: Median Household Income in Vermont, by County, 2013

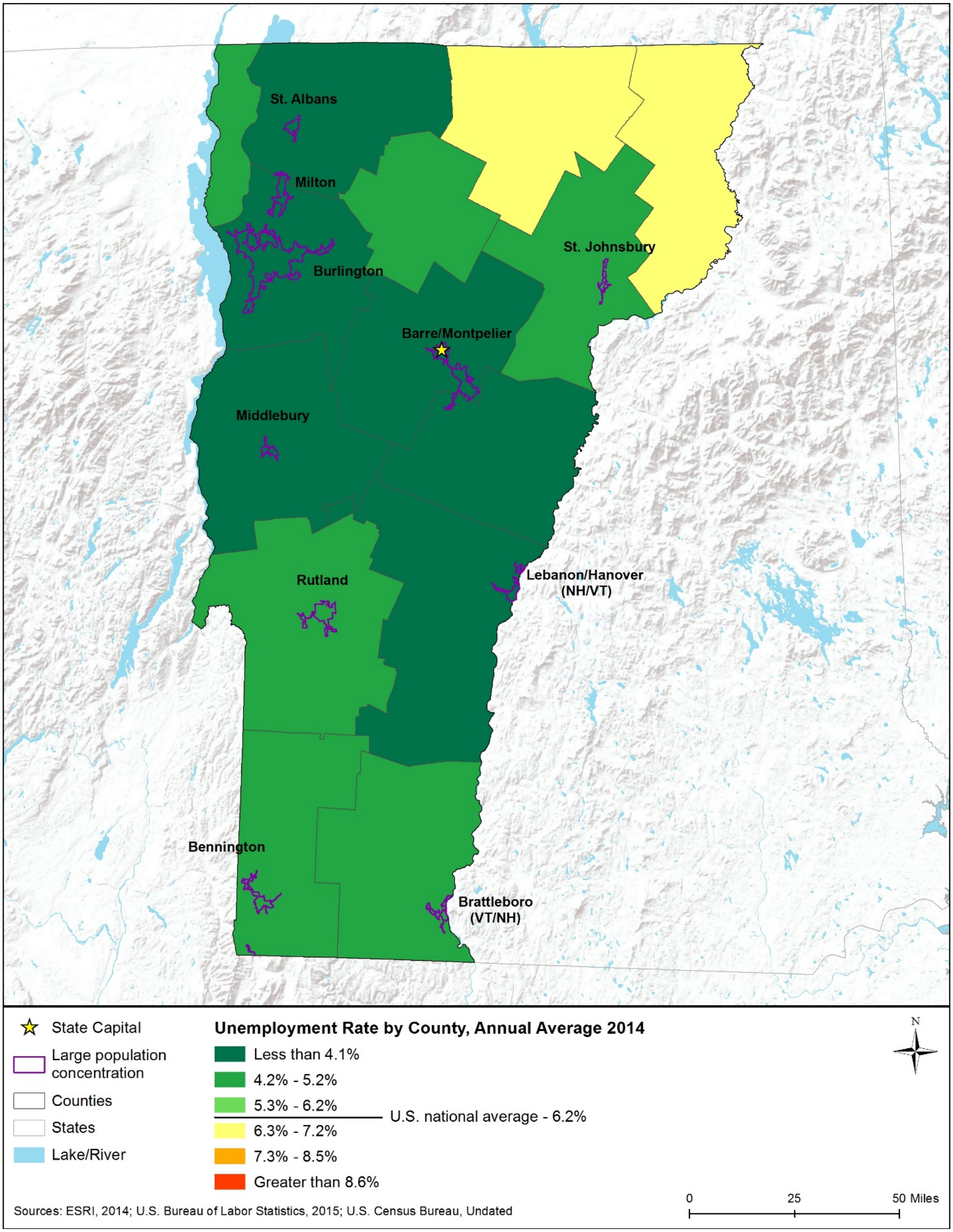

Figure 14.1.9-3: Unemployment Rates in Vermont, by County, 2014

Table 14.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Vermont	East Region	United States
Civilian Employed Population 16 Years and Over	322,899	35,284,908	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	76.1%	79.3%	79.7%
Government workers	14.3%	15.1%	14.1%
Self-employed in own not incorporated business workers	9.3%	5.4%	6.0%
Unpaid family workers	0.3%	0.1%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	2.4%	0.9%	2.0%
Construction	7.6%	5.8%	6.2%
Manufacturing	10.7%	8.5%	10.5%
Wholesale trade	1.9%	2.5%	2.7%
Retail trade	10.7%	11.1%	11.6%
Transportation and warehousing, and utilities	3.3%	4.6%	4.9%
Information	2.3%	2.3%	2.1%
Finance and insurance, and real estate and rental and leasing	4.7%	7.3%	6.6%
Professional, scientific, management, administrative, and waste management services	9.3%	12.3%	11.1%
Educational services, and health care and social assistance	28.6%	25.6%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	8.9%	8.9%	9.7%
Other services, except public administration	4.8%	4.9%	5.0%
Public administration	4.8%	5.5%	4.7%

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

Table 14.1.9-8 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 14.1.9-7 for 2013. The selected industries are those with the greatest relevance to FirstNet projects. In most of the 10 areas, the percentage of employment in the "Construction" industry was lower than the state average (7.4 percent). Only two areas had higher percentages for this industry, the highest being the Milton area at 10.6 percent.

Table 14.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in Vermont, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Barre/Montpelier	4.4%	2.1%	3.8%	9.8%
Bennington	5.4%	1.9%	1.5%	5.2%
Brattleboro (VT/NH) (VT Portion)	7.5%	2.7%	3.2%	4.5%

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Burlington	4.3%	2.7%	2.3%	10.6%
Lebanon/Hanover (NH/VT) (VT Portion)	2.0%	3.0%	2.0%	11.7%
Middlebury	1.4%	0.6%	2.2%	5.9%
Milton	10.6%	3.7%	1.9%	6.2%
Rutland	5.4%	2.8%	2.7%	5.7%
St. Albans	7.1%	4.4%	1.2%	8.8%
St. Johnsbury	3.7%	2.1%	4.1%	6.2%
Vermont (statewide)	7.4%	3.3%	2.1%	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 14.1.9-9 compares Vermont to the East region and nation on several common housing indicators.

As shown in Table 14.1.9-9, in 2013 Vermont had a lower percentage of housing units that were occupied (78.2 percent) than the region (88.4 percent) or nation (87.5 percent). Of the occupied units, Vermont had a considerably higher percentage of owner-occupied units (71.0 percent) than the region (62.8 percent) or nation (63.5 percent). This is reflected in the higher percentage of detached single-unit housing (also known as single-family homes) in Vermont in 2013 (66.7 percent) compared to the region (52.7 percent) and nation (61.5 percent). The vacancy rate among rental units was lower in Vermont (4.9 percent) than in the region (5.5 percent) or nation (6.5 percent).

Table 14.1.9-9: Selected Housing Indicators for Vermont, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Vermont	323,936	78.2%	71.0%	1.5%	4.9%	66.7%
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 14.1.9-10 provides housing indicators for the largest population concentrations in the state by 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.

As shown in Table 14.1.9-10, during this period the percentage of occupied housing units ranged between 87.8 to 96.7 percent across these population concentrations, which is consistent with the state percentage (79.6 percent). The Milton area had the highest percentage of occupied housing and the St. Johnsbury area had the lowest. In these 10 communities, the percentage of occupied housing units that were owner-occupied ranged from 42.5 percent (St. Johnsbury area) to 83.9 percent (Milton area). The homeowner vacancy rates ranged from 0.0 percent (Bennington and Milton areas) to 9.9 percent (Middlebury area), compared to the state rate of 1.8 percent. The vacancy rate among rental units ranged from 0.4 percent (Vermont portion of the Brattleboro area) to 10.6 percent (Milton area), compared to the state rate of 5.6 percent.

Table 14.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Vermont, 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
Barre/Montpelier	10,274	92.7%	59.6%	0.5%	4.3%	48.0%
Bennington	5,153	93.0%	53.2%	0.0%	3.0%	48.3%
Brattleboro (VT/NH) (VT Portion)	5,172	90.9%	45.2%	1.3%	0.4%	37.0%
Burlington	45,864	96.2%	56.0%	0.7%	2.3%	44.2%
Lebanon/Hanover (NH/VT) (VT Portion)	3,285	93.4%	55.8%	1.2%	7.1%	50.9%
Middlebury	1,711	88.3%	44.8%	9.9%	6.6%	41.8%
Milton	3,032	96.7%	83.9%	0.0%	10.5%	68.6%
Rutland	9,560	90.4%	55.9%	1.9%	7.0%	52.3%
St. Albans	4,130	92.8%	61.9%	1.2%	6.1%	49.2%
St. Johnsbury	2,602	87.8%	42.5%	5.6%	6.2%	34.4%
Vermont (statewide)	322,915	79.6%	71.0%	1.8%	5.6%	66.4%

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

Property Values

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

Table 14.1.9-11 provides indicators of residential property values for Vermont 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, 2015k).

The table shows that the median value of owner-occupied units in Vermont in 2013 ($218,300) was lower than the corresponding value for the East region ($249,074), but still considerably higher than the value for the nation ($173,900).

Table 14.1.9-11: Residential Property Values in Vermont, 2013

Geography	Median Value of Owner-Occupied Units
Vermont	$218,300
East Region	$249,074
United States	$173,900

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

Table 14.1.9-12 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 Burlington area had the highest median property value at $256,000. The lowest values were in the same two areas – St. Johnsbury ($145,500) and Bennington ($156,100) – that had the lowest median household incomes (Table 14.1.9-6).

Table 14.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Vermont, 2009–2013

Area	Median Value of Owner-Occupied Units
Barre/Montpelier	$164,100
Bennington	$156,100
Brattleboro (VT/NH) (VT Portion)	$188,900
Burlington	$256,000
Lebanon/Hanover (NH/VT) (VT Portion)	$223,600
Middlebury	$226,900
Milton	$235,300
Rutland	$161,000
St. Albans	$184,500
St. Johnsbury	$145,500
Vermont (statewide)	$216,800

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[120] 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 14.1.9-13 presents total and selected state and local government revenue sources as reported by the Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures are particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure. General and selective sales taxes may change, reflecting expenditures during system development and maintenance.

Table 14.1.9-13 shows that the state government in Vermont received more total revenue in 2012 on a per capita basis than counterpart state governments in the region and nation. The opposite is true for Vermont local governments. The Vermont state government had higher levels of intergovernmental[121] revenues per capita from the federal government than its regional and national counterparts, while the state's local governments had lower levels of these revenues. The Vermont state government obtained much higher revenues per capita from property taxes than other state governments. Local governments in Vermont obtained considerably lower levels of property taxes per capita than local governments in the region or nation. General sales tax revenues on a per capita basis were lower for the Vermont state and local governments compared to their counterparts in the region and nation. Selective sales tax revenues for Vermont's state government were significantly higher on a per capita basis than for state governments in both the region and nation. However, per capita public utility tax revenues specifically, for the state and local governments in Vermont, were considerably lower than for those governments in the region and nation. Finally, individual and corporate income tax revenues, on a per capita basis, were lower for the Vermont state government than for its counterparts in the region, but slightly higher than for its counterparts in the nation. Vermont local governments did not obtain revenues from individual or corporate income taxes.

[120] 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. Bureau of the Census 2006).
[121] Intergovernmental revenues are those revenues received from the Federal government or other government entities such as shared taxes, grants, or loans and advances.

Table 14.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		Vermont		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$6,349	$2,674	$522,354	$431,898	$1,907,027	$1,615,194
	Per capita	$10,142	$4,271	$7,132	$5,897	$6,075	$5,145
Intergovernmental from Federal	($M)	$1,904	$89	$135,435	$20,289	$514,139	$70,360
	Per capita	$3,042	$142	$1,849	$277	$1,638	$224
Intergovernmental from State	($M)	$0	$1,577	$0	$120,274	$0	$469,147
	Per capita	$0	$2,519	$0	$1,642	$0	$1,495
Intergovernmental from Local	($M)	$4	$0	$9,810	$0	$19,518	$0
	Per capita	$6	$0	$134	$0	$62	$0
Property Taxes	($M)	$949	$430	$2,215	$144,319	$13,111	$432,989
	Per capita	$1,516	$687	$30	$1,971	$42	$1,379
General Sales Taxes	($M)	$342	$9	$49,123	$15,874	$245,446	$69,350
	Per capita	$546	$15	$671	$217	$782	$221
Selective Sales Taxes	($M)	$626	$8	$38,070	$5,996	$133,098	$28,553
	Per capita	$1,000	$13	$520	$82	$424	$91
Public Utilities Taxes	($M)	$13	$2	$4,314	$2,261	$14,564	$14,105
	Per capita	$21	$3	$59	$31	$46	$45
Individual Income Taxes	($M)	$598	$0	$102,813	$18,838	$280,693	$26,642
	Per capita	$956	$0	$1,404	$257	$894	$85
Corporate Income Taxes	($M)	$97	$0	$14,112	$6,733	$41,821	$7,210
	Per capita	$154	$0	$193	$92	$133	$23

Sources: (U.S. Census Bureau, 2015s; U.S. Census Bureau, 2015t)
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. Bureau of the Census 2006).
Note: This table does not include all sources of government revenue. Summation of the specific source rows does not equal total revenue.

14.1.10. Environmental Justice

14.1.10.1. 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, 2013b).

In 1997, the Council on Environmental Quality (CEQ) issued *Environmental Justice: Guidance under the National Environmental Policy Act (NEPA)* to assist federal agencies in meeting the requirements of the EO (Council on Environmental Quality, 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." (Council on Environmental Quality, 1997)

14.1.10.2. Specific Regulatory Considerations

The ANR Department of Environmental Conservation (DEC) established an Environmental Assistance Office that provides environmental compliance support to communities, municipalities, and small businesses. DEC provides support to environmental justice communities to avoid potential disproportionate impacts related to new landfills and transfer stations. As part of this support, ANR developed a Solid Waste Management Plan to restrict the amount of waste sent to landfills located near environmental justice communities. (University of California, Hastings College of Law, 2010).

ANR also created a web-based map (Environmental Interest Locator) that displays geographic information about environmental sites (e.g., brownfields, hazardous waste sites) managed by the agency. This tool enables users to access environmental aspects and data sets for a hazardous waste site. (University of California, Hastings College of Law, 2010).

14.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 14.1.10-1 presents 2013 data on the composition of Vermont's population by race and by Hispanic origin. The state's population has considerably lower percentages of individuals who identify as Black/African American (1.1 percent), Asian (1.2 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 state's population of persons identifying as White (95.0 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 Vermont that identifies as Hispanic (1.5 percent) is also considerably 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. Vermont's All Minorities population percentage (6.0 percent) is considerably lower than that of the East region (34.0 percent) or the nation (37.6 percent).

Table 14.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for Vermont (12.3 percent) is somewhat lower than that for the East region (13.3 percent) and lower than that for the nation (15.8 percent).

Table 14.1.10-1: 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		
Vermont	626,630	95.0%	1.1%	0.3%	1.2%	0.0%	0.3%	2.1%	1.5%	6.0%
East Region	73,558,794	72.1%	14.4%	0.3%	5.8%	0.0%	4.8%	2.7%	12.2%	34.0%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

Source: (U.S. Census Bureau, 2015u)
"All Minorities" is defined as all persons other than Non-Hispanic White.

Table 14.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Vermont	12.3%
East Region	13.3%
United States	15.8%

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

14.1.10.4. Environmental Justice Screening Results

Analysis of environmental justice in a NEPA document typically begins by identifying potential environmental justice populations in the project area. Appendix D, Environmental Justice Methodology, presents the methodology used in this PEIS to screen each state for the presence of potential environmental justice populations. The methodology builds on CEQ guidance and best practices used for environmental justice analysis. It uses data at the census-block group level; block groups are the smallest geographic units for which regularly updated socioeconomic data are readily available at the time of writing.

Figure 14.1.10-1 visually portrays the results of the environmental justice population screening analysis for Vermont. 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, 2015aa; U.S. Census Bureau, 2015h).

Figure 14.1.10-1 shows that Vermont has many areas with high potential for environmental justice populations. The distribution of these high potential areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations. The distribution of areas with moderate potential for environmental justice populations is also fairly even across the state. Given Vermont's very low rates of minority populations, it is likely that Figure 14.1.10-1mostly reflects relative prevalence of low-income populations.

It is important to understand how the data behind Figure 14.1.10-1affect the visual impact of this map. Block groups have similar populations (hundreds to a few thousand individuals) regardless of population density. In sparsely populated areas, a single block group may cover tens or even hundreds of square miles, while in densely populated areas, block groups each cover much less than a single square mile. Thus, while large portions of the state outside the areas defined as large population concentrations show moderate or high potential for environmental justice populations, these low density areas reflect modest numbers of minority or low-income individuals compared to the potential environmental justice populations within densely populated areas. The overall effect of this relative density phenomenon is that the map visually shows large areas of the state having environmental justice potential, but this over-represents the presence of environmental justice populations.

It is also very important to note that Figure 14.1.10-1 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.

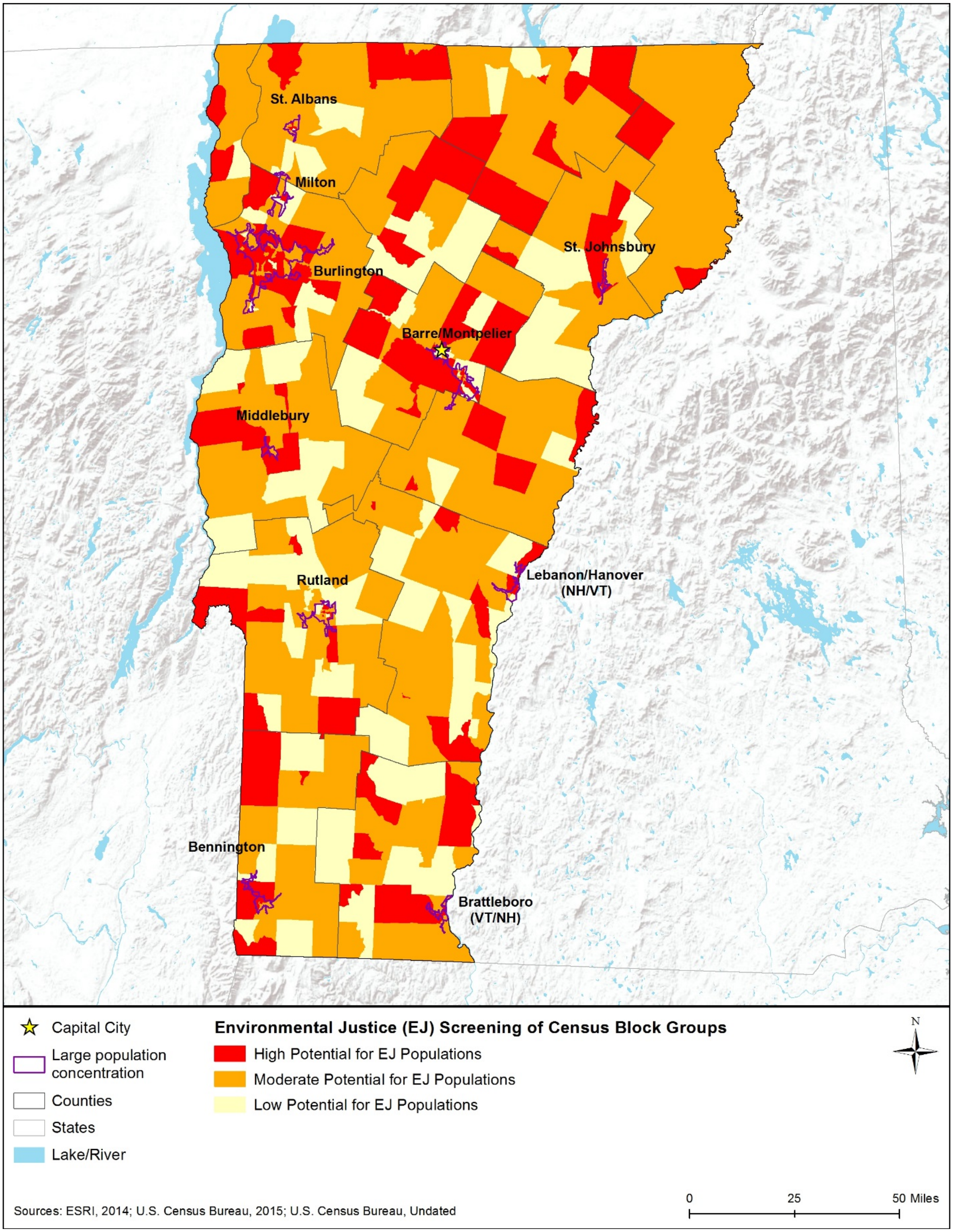

Figure 14.1.10-1: Potential for Environmental Justice Populations in Vermont, 2009–2013

Figure 14.1.10-1 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" (Council on Environmental Quality, 1997). The Environmental Consequences section (Section 14.2.10) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

14.1.11. Cultural Resources

14.1.11.1. Definition of the Resource

For the purposes of this PEIS, Cultural Resources are defined as:

> Natural or manmade structures, objects, features, locations with scientific, historic, and cultural value, including those with traditional religious or cultural importance and any prehistoric or historic district, site, or building included in, or eligible for inclusion in, the NRHP.

This definition is consistent with the how cultural resources are defined in the:

- Statutory language and implementing regulations for Section 106 of the NHPA, as amended, formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- Statutory language and Implementing regulations for the Archaeological Resources Protection Act of 1979 (ARPA), 16 U.S.C. 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 (Natural Resources Conservation Service, 2015g); 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).

14.1.11.2. Specific Regulatory Consideration

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 (AIRFA), ARPA, and NAGPRA. Appendix C summarizes these pertinent federal laws.

Vermont has a state law that parallels the NHPA (refer to Table 14.1.11-1). However, federal statutes supersede state laws and regulations. While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations.

Table 14.1.11-1: Relevant Vermont Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
The Vermont Historic Preservation Act, 22 V.S.A. Chapter 14	Vermont Division for Historic Preservation (SHPO)	This Act establishes that any "state agency, department, division or commission" must consult the Vermont SHPO before impacting a property that is included in the State Register of Historic Places. (Vermont General Assembly, 2015)

14.1.11.3. Cultural and Natural Setting

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

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

Archaeologists typically divide large study areas into regions as shown in Figure 14.1.11-1. Vermont contains one region, Appalachian Highlands, which is made up of three provinces. The St. Lawrence Valley occupies the northwest corner of the state bordering Lake Champlain. Just south is the Valley and Ridge province, which represents where the Hudson River Valley expands into Vermont. The New England Province contains the vast majority of the state's land area spanning from the southern to northwestern border. It is divided into four sections; Taconic, Green Mountain, New England Upland, and White Mountain.

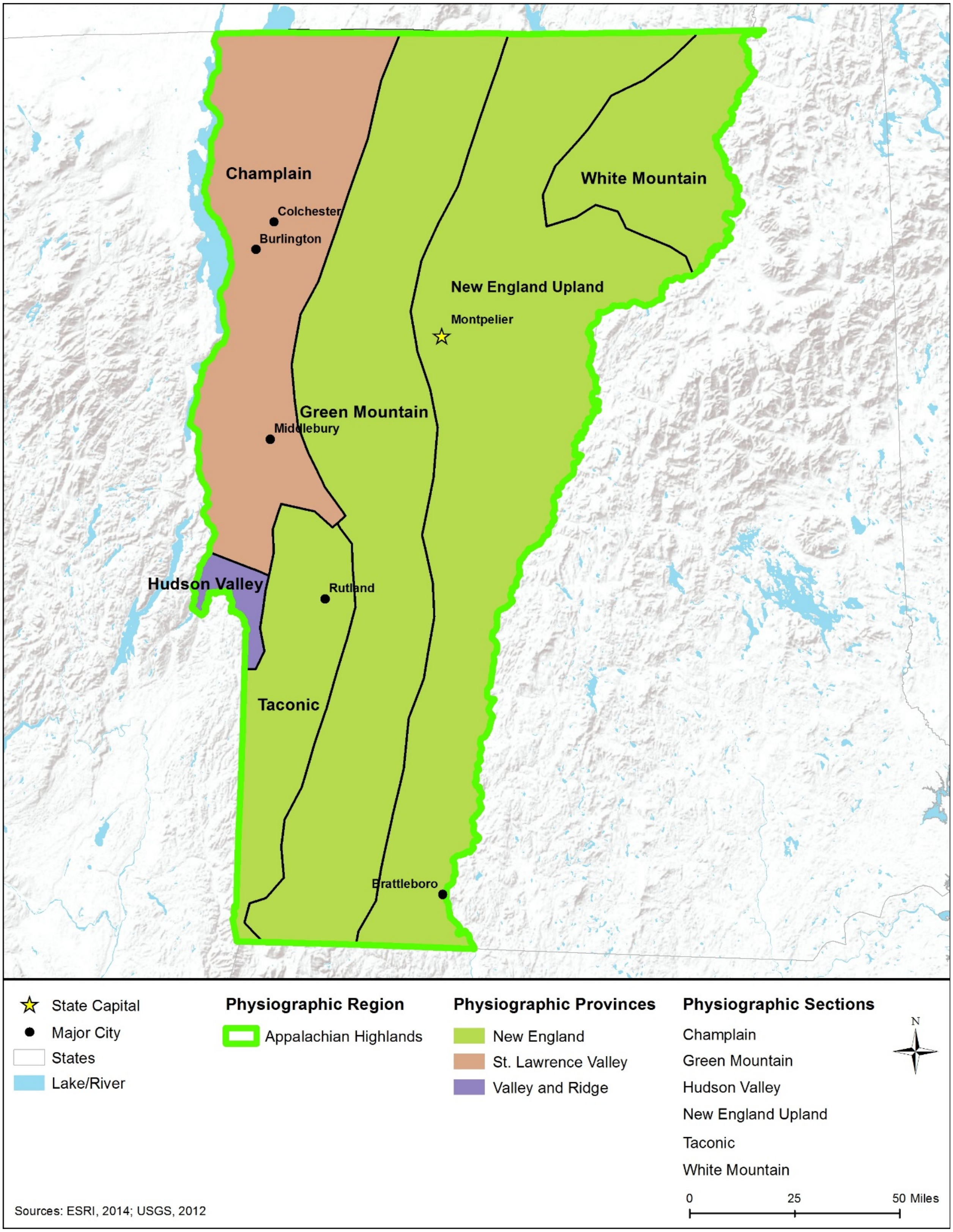

Figure 14.1.11-1: Vermont Physiographic Regions

14.1.11.4. Prehistoric Setting

There are three distinct periods associated with the prehistoric human populations that inhabited Vermont and the greater northeast geography of North America: the Paleoindian period (12,000 to 10,000 B.C.); Archaic (10,000 to 3,000 B.C.); and Woodland (3,000 B.C. to A.D. 1600). Figure 14.1.11-2 shows a timeline representing the periods of the evolving culture in this region. During early archaeological research, there was often no clear distinction between prehistoric periods in the archaeological record, due to overlaps between phases of cultural development (Ritchie W. A., 1969). Due to advancements in radiocarbon dating techniques, dates of each period in the archaeological record have been increasingly more accurate, and there is no longer much overlap in the timeline of human occupation in North America (Pauketat, 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).

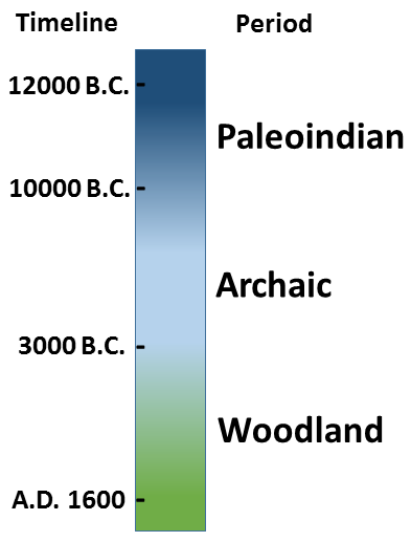

Figure 14.1.11-2: Timeline of Prehistoric Human Occupation

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

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

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

Paleoindian Period suggest that the inhabitants were few in numbers and their way of life is difficult to interpret and understand (Anderson, 2001).

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

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

During the Archaic period in Vermont and the greater northeastern portion of North America, people lived in small family based units, commonly referred to as bands. Temperatures were becoming warmer during this period because of the retreating glacial ice sheets, allowing for the plants and animals that inhabit this region today to begin to establish themselves. Much like the Paleoindian peoples that preceded them, Archaic Period people were hunter-gathers whose diet consisted of wild plants and animals. They gathered wild vegetable foods, hunted for game, and became very adept in fishing practices. Archaic Period peoples began building basic shelters and expanded on their ability to make stone weapons and stone tools. However, the culture lacked pottery, the smoking pipe, and technology associated with agriculture (Vermont Archaeological Society, 2015; Poultney Historical Society, 2013).

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

The people were beginning to form small bands (groups of approximately 25-50 people related by kinship and family ties), who were able to exploit the resources that were becoming increasingly abundant as the climate continued to warm. Early Archaic people made a diverse array of tools, such as scrapers, cutting instruments, and piercing tools, which allowed them to process animal and plant resources for consumption and use. Wild plants and animals composed the primary diet, however, people were becoming familiar with their environment, and some plants were domesticated and harvested in abundance. As food became more abundant and populations continued to grow, the range in which the people roamed began to decrease. First settlements were along rivers and tributaries (Vermont Archaeological Society, 2015; Poultney Historical Society, 2013).

Archaeological evidence suggest that by the Middle Archaic Period, the climate of Vermont had changed significantly to support a large expanses of mixed deciduous forests, rich in oak and other plant communities. Ecological conditions were much like those that exist today, with minor floral and faunal variations. The region was teaming with wild game, fowl, edible nuts, berries, tubers, roots, and various herbs, all of which would have supported larger populations of semi-nomadic peoples. According to archaeologists, the Middle Archaic Period was a time of dramatic change in the region. The freshwater systems throughout the region supported settlement, rudimentary agriculture, and travel and trade among family bands. The culture began developing instruments such as choppers, narrow-bladed projectile points, beveled adzes, cobbled hammerstones, and other small tools. The inhabitants had not developed very sophisticated food storage techniques during this period, so this may have resulted in an abundance of food during the warmer months and shortages of food during the colder months. This may have allowed for a cultural shift to a more sedentary lifestyle during times of abundance and required more nomadic lifestyle during the leaner winter months. Based on the tool assemblages found, it can be inferred that the people of this period were conducting a number of different daily activities, such as the processing of game, plants, and fish (Vermont Archaeological Society, 2015; Poultney Historical Society, 2013).

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

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

Similar to the Archaic Period, the Woodland Period is divided into three sequential sub-periods: Early, Middle, and Late. The three sub-periods are defined based on various cultural differences that can be distinguished by their temporal (place in time) location and adaptive details that come from close scientific examination. For a long time, archaeologists had a difficulty understanding this period of human development for the region around Vermont. In the Early Woodland Period, people continued to develop means to exploit the abundant flora and fauna of the region. By the late Woodland period, they were cultivating plants such a maize and beans. The main technology that differentiates the Woodland Period from the Archaic Period is the development and use of pottery, which originated in the Southeastern United States during the late Archaic Period and spread northward to Vermont and elsewhere (Sassaman, 1998) (Leveillee, Waller, & Ingham, 2006).

During the Early Woodland Period, the interior lakes and streams of modern day Vermont drained through the salt-water marshes and lagoons along the coast of the state. The region was teaming with wildlife during this time. The glacial ice sheets had melted enough to leave the area with a climate that could support an enormous variety of food sources and access to other natural resources. Tool technology continued to advance. The development of such technologies as ceramics is a good indicator that the people were developing a semi-sedentary lifestyle, and living in small villages (Leveillee, Waller, & Ingham, 2006).

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

The Middle Woodland Phase is generally associated with a variety of plain and decorated ceramic types as well as numerous lithic and bone tool types (Anderson, 2001; The Narragansett Society, 2015).

The archaeological record reveals a continuing change of lifestyle for the people in Vermont during the Late Woodland Period. The inhabitants of this time were able to exploit a variety of resources due to their ability to establish organized seasonal settlements. Wild and domesticated plants and animals provided the subsistence they needed for survival. Pottery of traditional classic Woodland lineage continued to undergo progressive modifications. This period is denoted distinctively by an increased dependence on horticulture (Alan Leveillee, Dispersed Villages in Late Woodland Period South-Coastal Rhode Island, 2006).

14.1.11.5. Federally Recognized Tribes of Vermont

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are no federally recognized tribes in Vermont (NCSL, 2015; GPO, 2015b). Figure

Vermont State Cultural Resources Database and Tools

Division of Historic Preservation

The Division of Historic Preservation serves as Vermont’s State Historic Preservation Office (SHPO). Its website provides the public with numerous resources, publications, consultant lists, preservation news and upcoming events, and links to related resources (State of Vermont, 2012).

The Vermont Archaeological Society (VAS)

Formed in 1968, the Vermont Archaeological Society (VAS) is a volunteer organization comprised of professional and avocational archaeologists and the interested public. The Society is committed to raising the awareness of Vermont’s past, while at the same time protecting its valuable cultural resources from injury and exploitation. VAS has various resources and materials that can be accessed through its website (http://www.vtarchaeology.org). There are links to the NRHP and various other resources, publications, information on fieldwork opportunities, and lesson plans for educators (Vermont Archaeological Society, 2015).

14.1.11-3 presents general locations of tribes that were known to exist in this region of the United States, but are not officially federally recognized.

14.1.11.6. Significant Archaeological Sites of Vermont

There are 16 archaeological sites in Vermont listed on the NRHP. Table 14.1.11-2: Archaeological Sites on the National Register of Historic Places in Vermont 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 http://www.nps.gov/nr/ (National Park Service, 2015d).

Table 14.1.11-2: Archaeological Sites on the National Register of Historic Places in Vermont

Closest City	Site Name	Type of Site
Barnet	Thresher Mill	Historic
Bellows Falls	Bellows Falls Petroglyph Site (VT-WD-8)	Prehistoric
Brandon	Forestdale Iron Furnace	Historic
Burlington	Burlington Bay Horse Ferry	Shipwreck
Burlington	GENERAL BUTLER (shipwreck)	Shipwreck
Burlington	O.J. WALKER (shipwreck)	Shipwreck
Charlotte	Mount Philo State Park	Prehistoric
Colchester	PHOENIX (Shipwreck)	Shipwreck
Elmore	Elmore State Park	Prehistoric
Hubbardton	Hubbardton Battlefield	Historic - Military
Orwell	Orwell Site	Historic, Historic - Aboriginal, Prehistoric
Pittsford	Fort Vengeance Monument Site	Historic - Military
Weathersfield	Historic Crown Point Road	Historic, Historic - Aboriginal, Military
Winooski	Winooski Archeological Site	Prehistoric
Woodstock	Slayton--Morgan Historic District	Historic
Woodstock	Woodstock Village Historic District	Historic

Source: (National Park Service, 2015n)

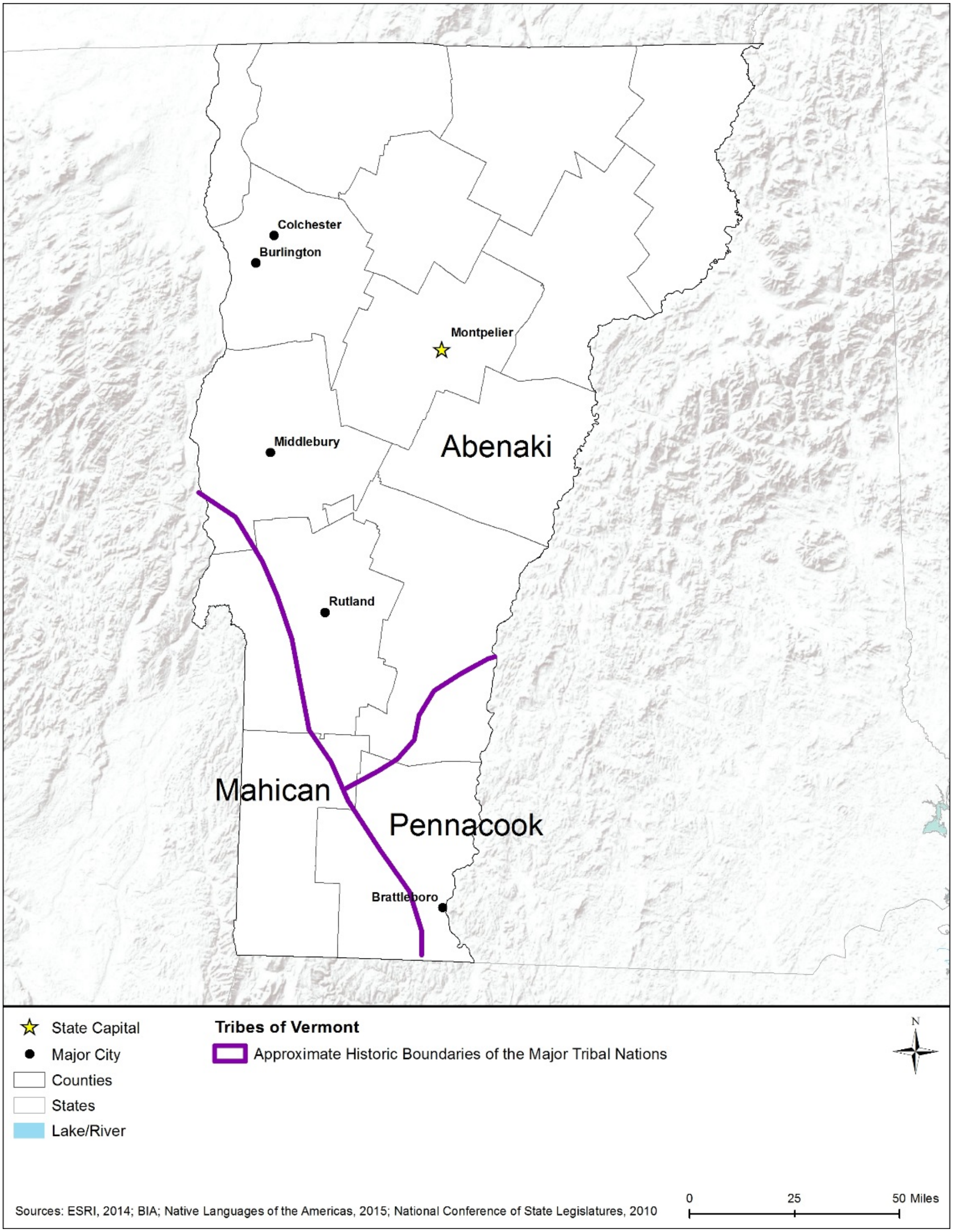

Figure 14.1.11-3: General Locations of Tribes That Historically Existed in Vermont

14.1.11.7. Historic Context

The first European known to have explored what is now Vermont was Samuel de Champlain in 1609. Champlain sailed south on Lake Champlain (which he named), as far as Ticonderoga, New York. During the 17th century, France and England fought for control of the Champlain River Valley, as the waterways in the area served as trade and transportation routes. "In 1666 Captain Pierre La Motte built the first fort on the lake (Fort St. Anne), on what is now Isle La Motte, as part of a line of French forts along the Richelieu River and Lake Champlain as a defense against the Iroquois and to protect trade routes" (LeGrande, 2015). Fort St. Anne was inhabited for around five years before being abandoned (LeGrande, 2015).

Settlement efforts were made by English colonists during the late 17th and early 18th centuries; however, the majority of these attempts were unsuccessful. Following the signing of the Treaty of Utrecht (1711), an agreement was reached that France would keep to the north of what is now Ferrisburgh, while the English would stay to the south. In 1731, despite the previous agreement, the French constructed a military installation at Chimney Point. French settlement on both sides of Lake Champlain continued up until the ensuing French and Indian War (1754 to 1763) (LeGrande, 2015).

England assumed control of Vermont following the French and Indian War, and French settlers burned their homes before retreating into Canada (LeGrande, 2015). Conflict over Vermont did not end with the French and Indian War, as New Hampshire and New York both claimed Vermont and made land grants in the area. During the American Revolution, American forces constructed a fort at Mount Independence, across from Fort Ticonderoga, in an attempt to maintain control of Lake Champlain; however, Mount Independence was quickly abandoned. On July 8, 1777, in the midst of war, Vermont ratified a new constitution and the Republic of Vermont was formed (Vermont Department of Housing and Community Development, 2015a).

Following the American Revolution, settlers returned to their land to rebuild and "on March 4, 1791, Vermont became the 14th state in the United States of America" (Vermont Department of Housing and Community Development, 2015a). During the early 19th century, Vermont was involved in agriculture, but the lumber industry became dominant in the middle of the 19th century. Lake Champlain was used to ship timber north where it was sold in Canada or brought to New York for shipment abroad. Burlington was a milling city, and timber from elsewhere was brought there for processing. Railroads played a key role in Vermont's development, with towns developing along rail lines as access increased (Klyza & Trombulak, 1999).

While Vermont did not see any Civil War battles within the state, they did send troops to fight for the Union. Following the Civil War, Vermont experienced a decline in farming and the forest was allowed to recover from the extensive clearing of the last century. The conservation movement became a major factor beginning in the late 19th century, which led to the growth of tourism related to Vermont's beautiful scenery. Outdoor retreats were built, similar to the Great Camps of the Adirondacks. Industrial activities, such as textile production, remained important throughout the early 20th century. During the second half of the 20th century, the population of Vermont has grown; however, the state has remained rural and the development of rural areas with suburban growth has been limited (Klyza & Trombulak, 1999).

Vermont has 833 NRHP listed sites, as well as 18 NHLs (National Park Service, 2015b). Vermont contains one National Heritage Area, the Champlain Valley National Heritage Partnership (National Park Service, 2015g). Figure 14.1.11-4: National Heritage Area (NHA) and NRHP Sites in Vermont shows the locations of NHA and NRHP sites within the state of Vermont.[122]

14.1.11.8. Architectural Context

Early European settlement in Vermont occurred near waterways and in areas that had been occupied by the indigenous population for thousands of years. Little remains of early French architecture, which consisted largely of fortifications to protect trades routes and small settlements. Early English and American towns were laid out in squares that divided and sold land to residents in uniform plots, reserving select lots for civic and institutional buildings. Norwich is an example of a town that was established in this way. In some cases, "early stone walls, roads, and hedgerows" still mark the borders of original lots (Andres, Johnson, & Liebs, 2014).

By the last quarter of the 18th century, a wide variety of house types existed throughout Vermont. Most were simple structures and included "log cabins, block (squared-log) houses, burrow houses, earth-fast ('crutch'-frame) houses, plank-wall cabins, one- and two-room frame types, Cape Cod and 'cross-passage' center chimney houses, and bank houses, as well as rare two-story center chimney houses" (Andres, Johnson, & Liebs, 2014). Most are gone, and many of the examples that still exist have been modified with later elements from the various revival styles (Andres, Johnson, & Liebs, 2014).

During the American Revolution, fortifications were constructed in strategic areas such as Mount Independence near Fort Ticonderoga. Following the American Revolution, residents continued to live in log or frame structures with large barns to house livestock (often English barns). Heavy timber-framed dwellings became more common as the 19th century progressed, with barns being a common and significant example throughout Vermont. The availability of manufactured goods lagged behind more populated areas of the country so houses often had less ornate details and fewer windows. Regional variations arose based on population, with Cape Cod houses being common. Civic buildings were often built in a higher style by prominent architects, particularly as the 19th century progressed (Andres, Johnson, & Liebs, 2014).

Greek Revival became popular during the second quarter of the 19th century, and many residential, institutional, and commercial structures were built in this style. As marble and granite were mined in Vermont, stone structures became popular. Cape Cod houses that were adapted with Greek Revival elements were known as "Classic Cottages." Gothic Revival, Italianate, Second Empire, and other Victorian Era styles appeared as well. In many instances these styles were applied to the standard cottage as an update to update the residence. Connected farm building similar to those found throughout New England were built in Vermont as well (Andres, Johnson, & Liebs, 2014).

[122] See Section 14.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

Beginning in the mid-19th century, factories transitioned from water to steam power, allowing for greater latitude with respect to their location. Queen Anne houses grew in popularity during the late 19th century, as did downtown buildings of increasing height during the early 20th century. Richardsonian Romanesque was popular during the late 19th century and can be seen on the campus of the University of Vermont, as can the Beaux Arts style. Vacation architecture became popular, with rustic cabins being constructed to house city dwellers drawn to the rural environment of Vermont. These houses were often rustic structures with similarities to the Adirondack Great Camps of New York (Andres, Johnson, & Liebs, 2014).

Due to the economic slump prior to WWII, Vermont has less Art Deco and Art Moderne architecture than the rest of the country. World War II (WWII) revived the economy temporarily; however, industrial production and commercial activity fell again following the war, and as a result there is minimal architecture of the International style. Suburban development around Burlington increased with the arrival of General Electric and IBM, which brought both residential and commercial growth (Andres, Johnson, & Liebs, 2014).

There are many historic educational facilities in Vermont, including the University of Vermont, which dates to 1791. Schools for early education first appeared as one room school houses during the 18th century, and grew in number and size during the 19th century (National Register of Historic Places, 1993). Jails and courthouses were some of the earliest government structures and were built beginning in the late 18th century. As the size of the government grew, the size of these facilities grew, with many Greek Revival examples being constructed during the 19th century. The growth of these civic institutions was significant to the state as it was seen as a representation of the civilization and domestication of the area (National Register of Historic Places, 1994). Early churches and meeting houses of a variety of styles are common in Vermont and are significant to the settlement of towns and villages throughout the state (National Register of Historic Places, 2001).

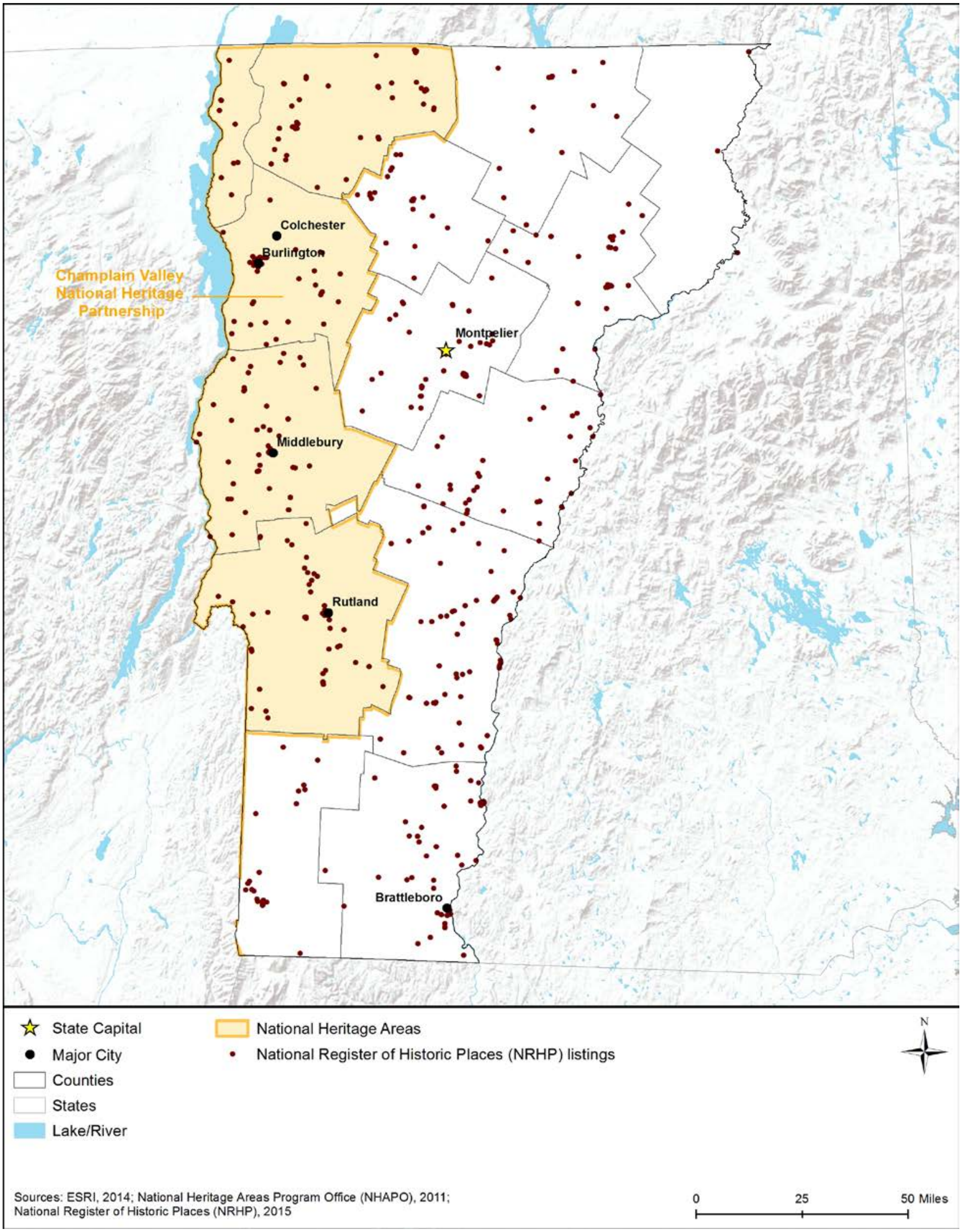

Figure 14.1.11-4: National Heritage Area (NHA) and NRHP Sites in Vermont[123]

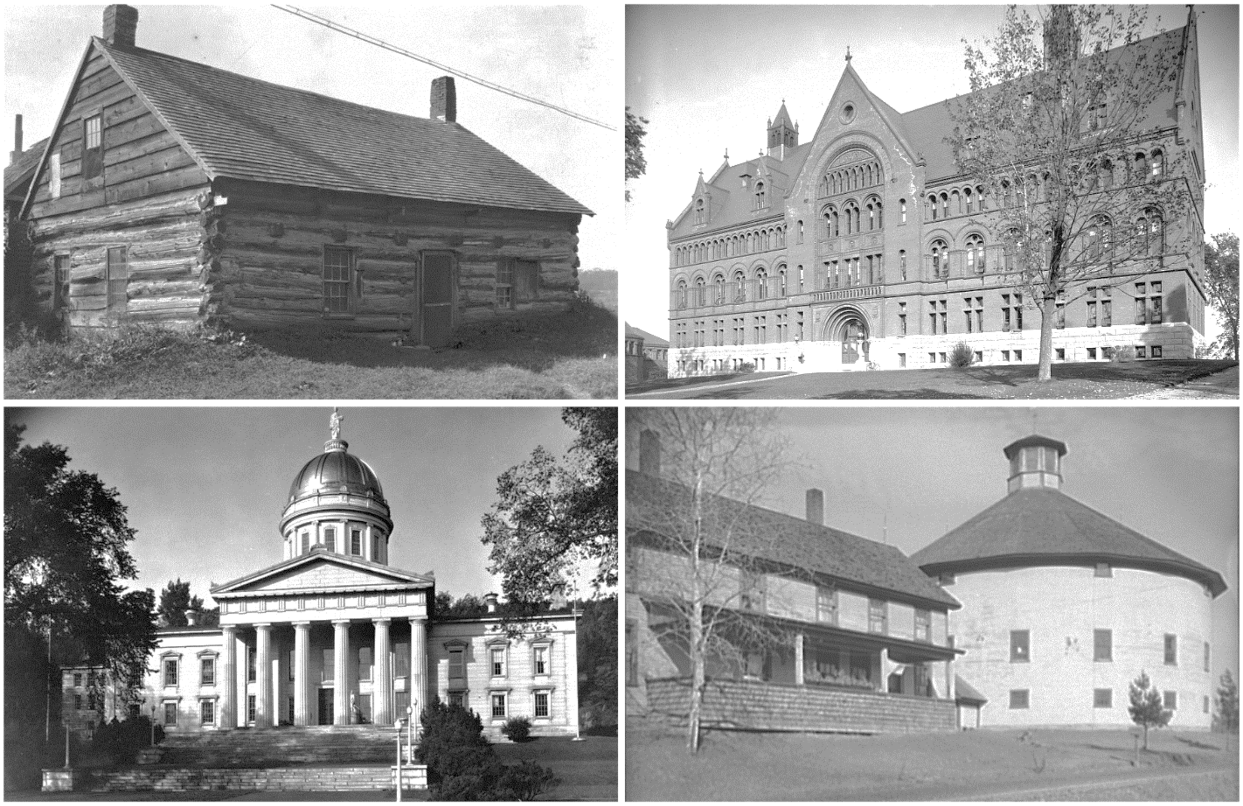

Figure 11.14.8-1: Representative Architectural Styles of Vermont

Top Left – Hyde-Jackson Log Cabin (Grand Isle, VT) – (Historic American Building Survey, 1933a)
Bottom Left – Vermont State House (Montpelier, VT) – (Historic American Building Survey, 1933b)
Top Right – Williams Science Hall, University of Vermont (Burlington, VT) – (Detroit Publishing Company, 1906)
Bottom Right – Round Barn (Caledonia County, VT) – (Rothstein, 1937)

14.1.12. Air Quality

14.1.12.1. Definition of the Resource

Air quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography[124] 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)[125] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[126] This section discusses the existing air quality in Vermont. The USEPA designates areas within the United States as attainment,[127]

[123] The oddly shaped polygons in this figure are artifacts of available data of NRHP district listings. The accuracy of the location data for these resources varies, resulting in variations in the appearance of each resource.
[124] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[125] Equivalent to 1 milligram per liter (mg/L)
[126] 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, 2015f)
[127] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant. (USEPA, 2015g)

nonattainment,[128] maintenance,[129] or unclassifiable[130] 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.

14.1.12.2. 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[131] or secondary,[132] 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 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. VT Appendix B, Table B-1, presents a list of federally regulated HAPs.

Vermont also regulates their own Hazardous Ambient Air Standards (HAAS). HAAS are the highest acceptable concentration of hazardous contaminants in the ambient air, as determined by Section 5-261(6) of Vermont's Air Pollution Control Regulations. The provisions of Section 5-261 state that if a source is above the threshold identified by the HAAS (Appendix C of Vermont's Air Pollution Control Regulations), additional controls are required for regulating the source. The following select activity is exempt:

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[128] 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, 2015g).

[129] 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, 2015g)

[130] 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, 2015g)

[131] 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, 2014b)

[132] 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, 2014b)

- "Solid fuel burning equipment (not including incinerators) … and all fuel burning equipment which combusts virgin liquid or gaseous fuels." (Vermont Agency of Natural Resources, 2014b)

Vermont has adopted the NAAQS, but also has additional state-only standards for sulfates (see Table 14.1.12-1) (Vermont Agency of Natural Resources, 2014b).

Table 14.1.12-1: Vermont Ambient Air Quality Standards for Sulfates

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		µg/m³	ppm	µg/m³	ppm	
Sulfates	24-hour	-	-	2	-	---
	Summer Seasonal	-	-	2	-	Summer seasonal arithmetic mean, April to September inclusive.

Source: (DEC, 2015x)

Title V Operating Permits/State Operating Permits

Vermont 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, 2015h). The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (USEPA, 2015h). Section 5-1003 [Applicability] of the Vermont Air Quality and Climate Division Regulations describes the applicability of Title V operating permits (Vermont Agency of Natural Resources, 2014b). Vermont 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 14.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014c).

Table 14.1.12-2: Major Air Pollutant Source Thresholds

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

Source: (USEPA, 2014c)

Exempt Activities

As defined by Section 5-401 [Classification of Air Contaminant Sources] of the Vermont Air Quality & Climate Division Regulations, air contaminant sources are defined as "sources which may cause or contribute to air pollution. Air contaminant sources do not include the following:

- "Stationary reciprocating internal combustion engines using any fuel type and having a rating of less than 450 brake horsepower output; and
- Unless otherwise required by the Air Pollution Control Officer, any stationary source with actual emissions from the entire source of less than five (5) tons per year of all air contaminants combined and that is not engaged in the operations, processes, or activities

identified above in Section 5-401(a)(1), (2), (5), (6), (13), (16), or (17) shall not be classified as an air contaminant source provided that the owner/operator maintains records that are adequate for the Air Pollution Control Officer to verify actual emissions for three (3) years and makes such records available to the Air Pollution Control Officer upon request." (Vermont Agency of Natural Resources, 2014b)

The subchapter pertaining to operating permits of the Vermont Air Quality & Climate Division Regulations states that major source permitting excludes insignificant activities. As defined by Section 5-1002 [Definitions] of the Vermont Air Quality & Climate Division Regulations, insignificant activities include:

- "Construction activities excluding fugitive dust;
- Internal combustion engine generator sets rated less than 37 kW (50 hp)…;
- Emergency use engines [133] [provided they do not operate more than 200 hours per calendar year]…;
- Any other activity determined to be insignificant by the Secretary of the Agency of Natural Resources[134] on the basis of the minimal quantity of emissions and impracticality with respect to quantifying emissions provided such determination is consistent with the federal Clean Air Act [42 U.S.C. 7401, et seq.], the Vermont Air Pollution Control Act [10 V.S.A. 551, et seq., as amended] and the regulations promulgated thereunder; and
- The engine of any motor vehicle including, but not limited to, any forklift or tractor." (Vermont Agency of Natural Resources, 2014b)

Temporary Emissions Sources Permits

The state of Vermont does not have regulations for temporary emission source permitting. Any temporary emission sources should review stationary source requirements, or contact the state for additional assistance.

State Preconstruction Permits

Construction permits are required for "new construction, installation or modification of any stationary source classified as an air contaminant source under Section 5-401 herein, unless he or she first submits a complete application to and obtains a permit from the Secretary." (Vermont Agency of Natural Resources, 2014b)

General Conformity

Established under Section 176(c)(4) of the CAA, the General Conformity Rule ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state's plans to meet national standards for air quality outlined in the state implementation plan (SIP) (USEPA, 2013b). An action in designated nonattainment and maintenance areas would be

[133] Emergency use engines: The state of Virginia defines emergency use engines as any engine that is used for emergency, i.e. emergency generators and emergency pumps.
[134] Secretary of the Agency of Natural Resources: The Secretary, Deborah Markowitz, works with the Agency of Natural Resources to protect Vermont's environment, wildlife, and natural resources as well as Vermont's forests and state parks. The Secretary has the authority to deem activities exempt from the provisions of Title V Operating permits (VTrans, 2015c).

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*[135] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 14.1.12-3). All Vermont 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 14.1.12-3: *De Minimis* Levels

Pollutant	Area Type	TPY
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
Ozone (NO_X)	Marginal and Moderate Nonattainment inside an OTR	100
	Maintenance	100
Ozone (VOC)	Marginal and Moderate Nonattainment inside an OTR	50
	Maintenance within an OTR	50
CO, Sulfur Dioxide (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 14.1.12-3, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 14.1.12-3, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity[136], 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;

[135] Small amount or minimal.
[136] Conformity: Compliance with the State Implementation Plan.

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

State Implementation Plan Requirements

Vermont's SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Vermont's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Vermont's SIP actions are codified under 40 CFR Part 52 Subpart UU. A list of all SIP actions for all six criteria pollutants can be found on the Vermont DEC website[137] (DEC, 2015y).

14.1.12.3. 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. The state of Vermont is in attainment and does not contain any nonattainment or maintenance areas.

Air Quality Monitoring and Reporting

The Vermont DEC measures air pollutants at five sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network (DEC, 2015z). Annual Vermont State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. The Vermont DEC reports real-time pollution levels of O_3 and $PM_{2.5}$ on their website (http://www.anr.state.vt.us/air/monitoring/cfm/RealTimeData.cfm) to inform the public, as O_3 and $PM_{2.5}$ are the main pollutants of concern in Vermont.

Air Quality Control Regions

The USEPA classified all land in the United States as a Class I, Class II, or Class III Federal Air Quality Control Region (AQCR). Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size. Class I areas cannot be re-designated as Class II or Class III and are intended to maintain pristine air quality. Although USEPA developed the standards for a Class III AQCR, to date they have not actually classified any area

[137] http://Stateanr.state.vt.us/dec/dec.htm

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[138] of a Class I area. "The EPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (Page, 2012). The 2005 USEPA guidelines for air quality modeling do not provide a precise modeling range for Class I areas.

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 50 kilometers[139] (the normal useful range of EPA-approved Gaussian plume models" (Seitz, Clarification of Prevention of Significant Deterioration (PSD) Guidance for Modeling Class I Area Impacts, Environmental Protection Agency, 1992a).

Vermont has one Class I area, Lye Brook Wilderness, and New Hampshire has two Class I areas (the Great Gulf Wilderness and the Residential Rage-Dry River Wilderness Areas) where the 100-kilometer buffer intersects Vermont counties. If an action is considered major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (Seitz, 1992b). Figure 14.1.12-1 provides a map of Vermont highlighting all relevant Class I areas and all areas within a 100-kilometer radius. The numbers next to each of the highlighted Class I areas in Figure 14.1.12-1 correspond to the numbers and Class I areas listed in Table 14.1.12-4.

Table 14.1.12-4: Relevant Federal Class I Areas

#	Area	Acreage	State
1	Lye Brook Wilderness	12,430	VT
2	Great Gulf Wilderness Area	5,552	NH
3	Presidential Range-Dry River Wilderness Area	20,000	NH

Source: (USEPA, 2012)

[138] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.
[139] The memorandum and associated guidance use kilometers. 50 kilometers is equal to about 31 miles.

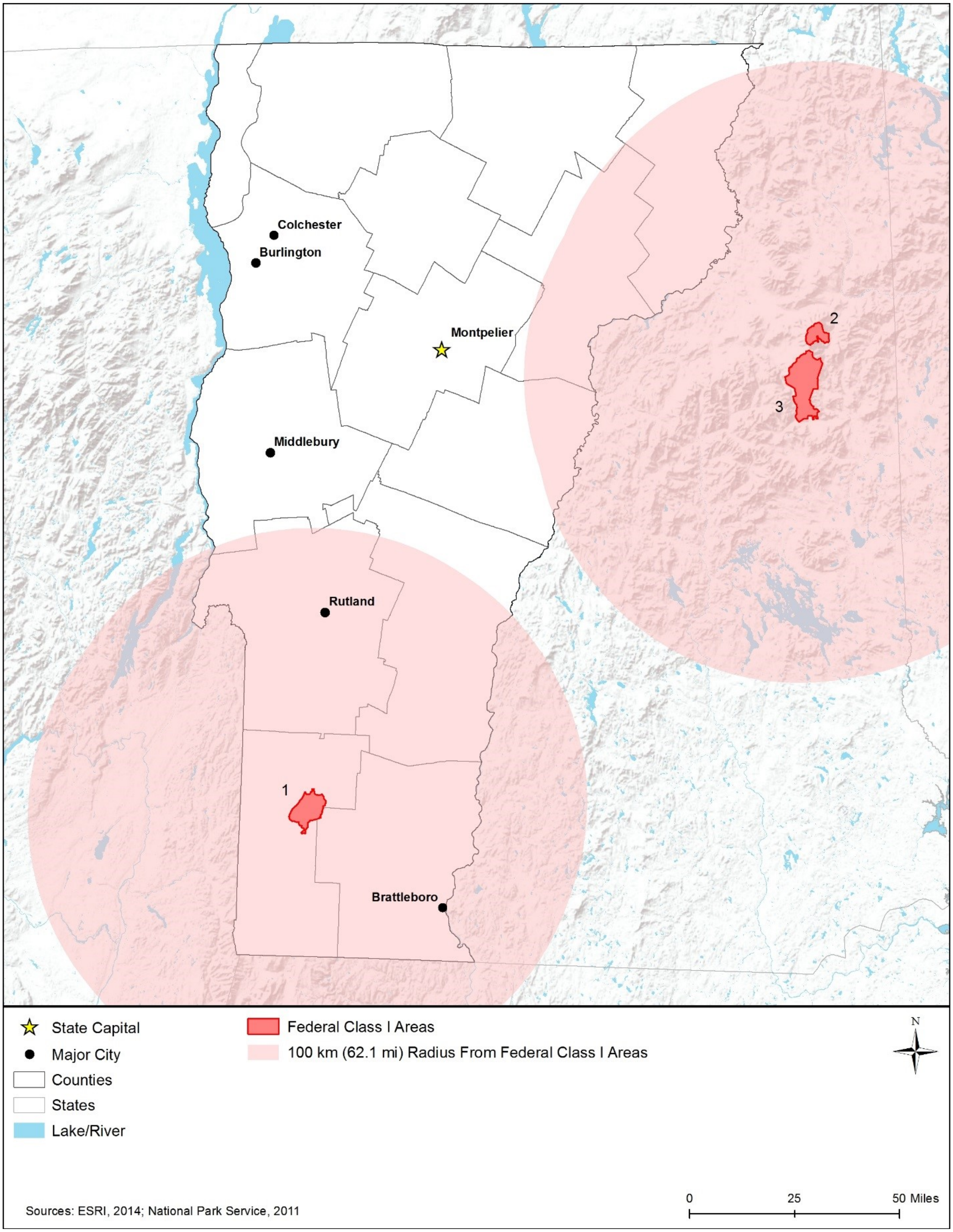

Figure 14.1.12-1: Federal Class I Areas with Implications for Vermont

14.1.13. Noise

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

14.1.13.1. Definition of the Resource

Noise is a form of sound caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012a). Noise is one of the most common environmental issues that interferes with normal human activities and otherwise diminishes the quality of the human environment. Typical sources of noise that result in this type of interference in urban and suburban surroundings includes interstate and local roadway traffic, rail traffic, industrial activities, aircraft, and neighborhood sources like lawn mowers, leaf blowers, etc.

The effects of noise can be classified into three categories:

- Noise events that result in annoyance and nuisance;
- Interference with speech, sleep, and learning; and
- Physiological effects such as hearing loss and anxiety.

Fundamentals of Noise

For environmental noise analyses, a noise metric refers to the unit that quantitatively measures the effect of noise on the environment. The unit used to describe the intensity of sound is the decibel (dB). Audible sounds range from 0 dB ("threshold of hearing") to about 140 dB ("threshold of pain"). The normal audible frequency range is approximately 20 Hz to 20 kHz (Federal Aviation Administration, 2015i). 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 (Occupational Safety and Health Administration, 2013).

Measurements and descriptions of noise (i.e., sounds) are based on various combinations of the following factors (Federal Transit Authority, 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 14.1.13-1 presents the sound levels of typical events that occur on a daily basis in the environment. For example, conversational speech is measured at about 55 to 60 dBA, whereas a band playing loud music may be as high as 120 dBA (Occupational Safety and Health Administration, 2013).

Because of the logarithmic unit of measurement, sound levels cannot be added or subtracted linearly. However, several simple methods of estimating sound levels can be useful in determining approximate sound levels. First, if two sounds of the same level are added, the sound level increases by approximately three dB (for example: 60 dB + 60 dB = 63 dB). Secondly, the sum of two sounds of a different level is slightly higher than the louder level (for example: 60 dB + 70 dB = 70.4 dB).

The changes in human response to changes in dB levels is categorized as follows (Federal Transit Authority, 2006):

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

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

14.1.13.2. 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.

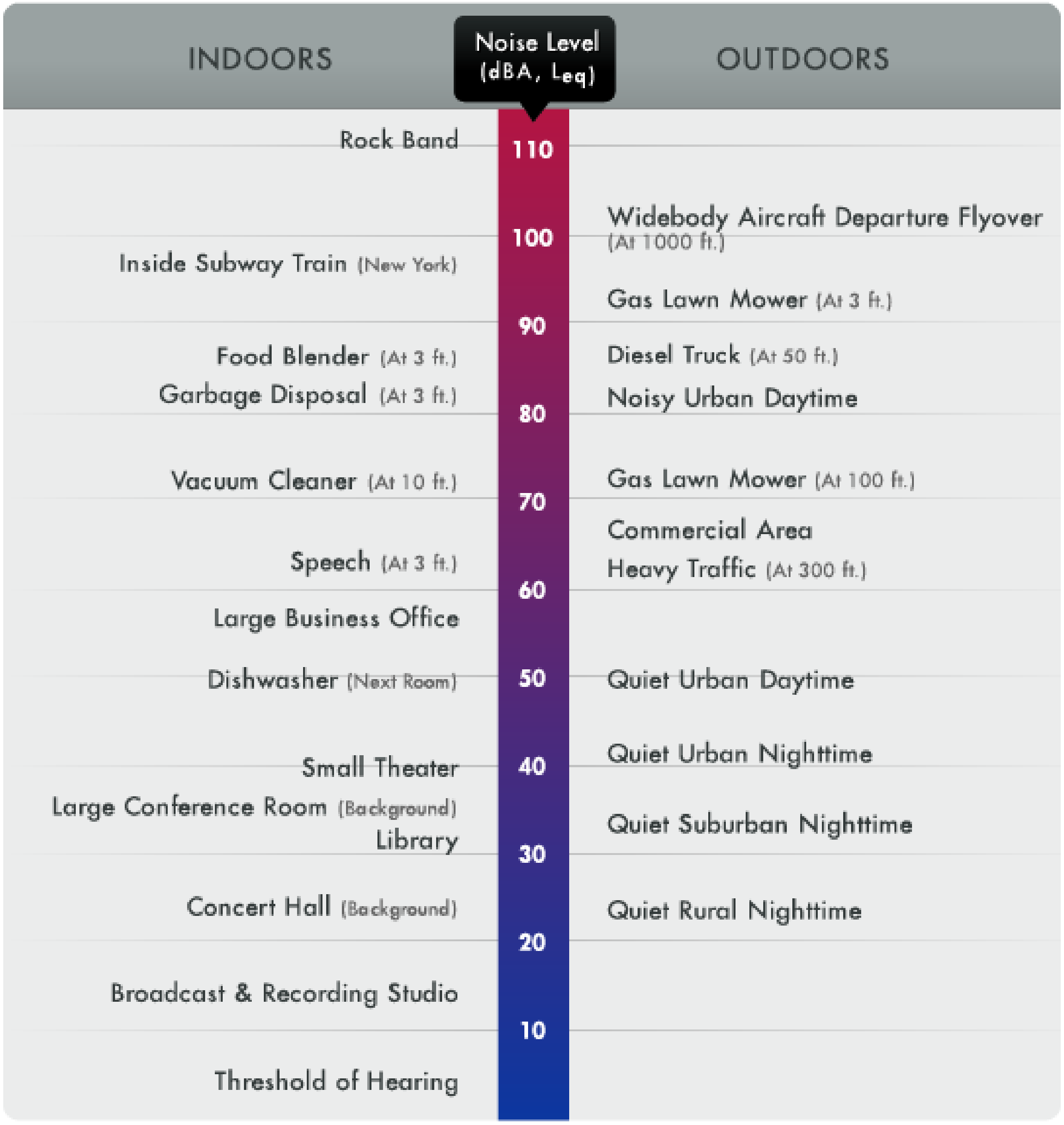

Figure 14.1.13-1: Sound Levels of Typical Sounds

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

Vermont has several statewide laws that regulate noise, specifically for snowmobiles, motorboats, and all-terrain vehicles (Vermont General Assembly, 2015). These noise laws are not applicable for this Proposed Action. However, large cities and towns are likely to have different regulations than rural or suburban communities largely due to the population density and difference in ambient noise levels (DOT, 2011). For instance, the Burlington Noise Control Ordinance (Sec. 21-13) prohibits unreasonable noise without specifying a decibel limit (City of Burlington, Vermont, 2015).

14.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in Vermont varies widely based on the area and environment. The population of Vermont can choose to live and interact in areas that are large cities, suburban neighborhoods, rural communities, and national and state parks. Figure 14.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Vermont may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Vermont. As such, this section describes the areas where the population of Vermont 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 urban areas that are likely to have the highest ambient noise levels in the state are Burlington, Essex, South Burlington, and Colchester.

- **Airports:** Areas surrounding airports tend to have higher noise levels due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (Federal Aviation Administration, 2007). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (Federal Aviation Administration, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports is in proximity to urban communities, resulting in noise exposure from aircraft operations (arrivals/departures) to the surrounding areas at higher levels and with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In Vermont, BTV has combined annual operations of more than 73,000 flights (Federal Aviation Administration, 2015j). These operations result in increased ambient noise levels in the surrounding communities. See Section 14.1.1, Public Safety Infrastructure 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 (DOT, 2015e). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living near those traffic corridors. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (DOT, 2015e). See Section 14.1.1, Public Safety Infrastructure for more information about the major highways in the state.

- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (Federal Transit Authority, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (DOT, 2015f). Vermont has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend from Burlington to Bennington, Saint Albans to Bellows Falls, and from Newport to White River Junction. There are also a number of other rail corridors that join these major rail lines and connect with other cities (VTrans, 2013). See Section 14.1.1, Public Safety Infrastructure 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 some being located in wilderness areas. National and state parks, historic areas, and monuments are protected areas, which are regions that are given legal safeguards in order to maintain biological diversity and natural resources (National Park Service, 2013). These areas typically have lower noise levels, as low as 30 to 40 dBA (National Park Service, 2014c). Vermont has 2 national parks and 12 National Natural Landmarks (National Parks Conservation Association, 2015) (National Park Service, 2015b). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 14.1.8, Visual Resources for more information about national and state parks for Vermont.

14.1.13.4. 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 (Bureau of Land Management, 2014). Most cities, towns, and villages in Vermont have at least one school, church, or park, in addition to likely having other noise-sensitive receptors. There are most likely thousands of sensitive receptors throughout the State of Vermont.

14.1.14. Climate Change

14.1.14.1. 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." (Intergovernmental Panel on Climate Change, 2007)

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) primarily caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 2012b). The IPCC is now 95 percent certain that humans are the main cause of current global warming (Intergovernmental Panel on Climate Change, 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) (Intergovernmental Panel on Climate Change, 2007). The common unit of measurement for GHGs is metric tons of CO_2-equivalent (MT CO_2e), which equalizes for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units are in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units are in MMT CO_2e.

The IPCC reports that "global concentrations of these four GHGs have increased significantly since 1750" with "Atmospheric concentrations of CO_2 increased from 280 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (Intergovernmental Panel on Climate Change, 2007). The atmospheric concentrations of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270 parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (Intergovernmental Panel on Climate Change, 2007). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (Intergovernmental Panel on Climate Change, 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 14.2.14, 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; and 3) severe weather events (including blizzards and hurricanes).

14.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C. Vermont has established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 14.1.14-1, key state laws/regulations are the primary policy drivers on climate change preparedness and GHG emissions.

In addition, Vermont developed the Vermont Agency of Natural Resources Climate Change Adaptation Framework, which aims to "gather information about climate change in Vermont as it relates to natural resources and to propose a strategic framework for continued climate change vulnerability assessment and action planning" (Vermont Agency of Natural Resources, 2013). Vermont 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).

Table 14.1.14-1: Relevant Vermont Climate Change Laws and Regulations

State Laws/Regulations	Regulatory Agency	Applicability
Executive Order No. 07-05: Vermont Governor's Commission on Climate Change (December 2005)	Vermont Agency of Natural Resources	Established the Governor's Commission on Climate Change (GCCC), "to develop an accurate picture of Vermont's past, present, and future GHG emissions and a comprehensive set of policy recommendations for reducing Vermont's GHG emissions from all sectors, consistent with the state's need for continued economic growth and energy security (Vermont Natural Resources Council, 2007)."
Executive Order 05-11: Climate Cabinet of the Vermont State Government (May 2011)	Vermont Agency of Natural Resources	Created the Climate Cabinet of the Vermont State Government, which was to be chaired by the Secretary of the Agency of Natural Resources. The purpose of the Cabinet is to provide leadership by coordinating climate change efforts and implementing energy efficiency measures amongst other tasks. (State of Vermont, 2008)
10 V.S.A. 578 Greenhouse Gas Reduction Goals (2011)	Vermont Agency of Natural Resources	Established goals to reduce emissions from 1990 baseline levels as follows: 25 percent by 2012; 50 percent by 2028; and, if practicable using reasonable efforts, 75 percent by 2050. (Vermont Agency of Natural Resources, 2010) (Vermont Agency of Natural Resources, 2014c)

14.1.14.3. Vermont Greenhouse Gas Emissions

Estimates of Vermont's total GHG emissions vary. The Department of Energy's (DOE) EIA collects and disseminates national-level emissions data on other GHGs such as CH4 and nitrous oxide (NOx), but these are not broken down by state (U.S. Energy Information Administration, 2015f). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015i). Individual states have developed their own GHG inventories and these are updated with different frequencies and trace GHG in different ways.

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

According to the EIA, Vermont emitted a total of 5.2 MMT of CO_2 in 2013. Transportation was the largest emitter, accounting for more than half percent of total CO_2 emissions (Table 14.1.14-2) (U.S. Energy Information Administration, 2015f). Vermont's CO_2 emissions increased from 1980 to a high of 7.0 MMT in 2004, then declined to their current levels. Overall increases were driven by petroleum and, in the early 2000s, natural gas. Declines subsequent to 2004 were almost entirely in petroleum products. In 2013 Vermont ranked 50th among the fifty states and the District of Columbia for total CO_2 emissions, and 50th for per-capita CO_2 emissions (U.S. Energy Information Administration, 2015g), the lowest, after the District of Columbia.

Table 14.1.14-2: Vermont CO_2 Emissions by Fuel Type and Source, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	1.3	Residential	1.3
Petroleum Products	5.1	Commercial	0.8
Natural Gas	0.5	Industrial	0.4
		Transportation	3.2
		Electric Power	0.0
Total	**5.6**	**Total**	**5.6**

Source: (U.S. Energy Information Administration, 2015f)

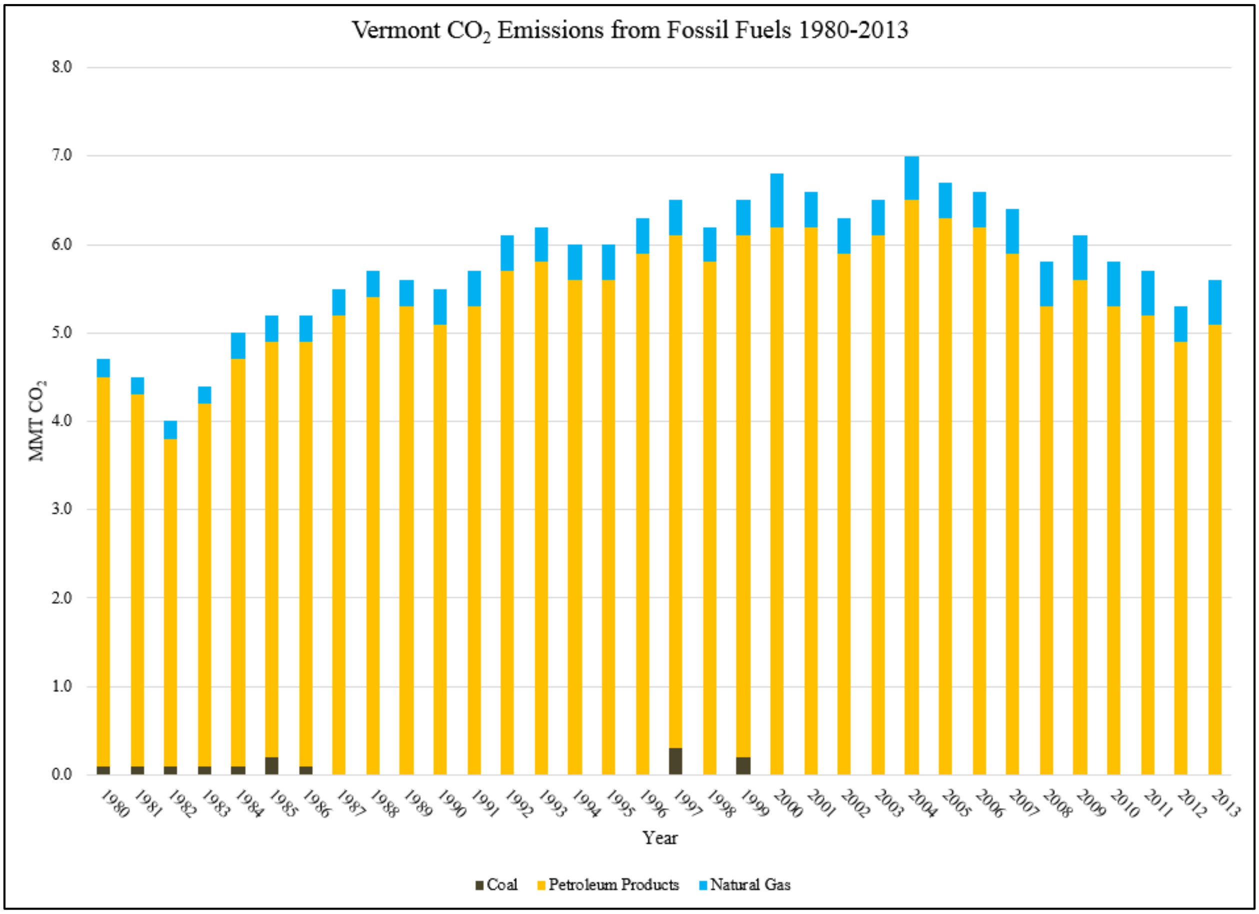

Figure 14.1.14-1: Vermont CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (U.S. Energy Information Administration, 2015f)

Vermont maintains its own GHG emissions inventory, which is updated regularly, most recently updated with 2012 data. Statewide GHG emissions were estimated at 8.1 MMT CO_2e, approximately 2 percent higher than their 1990 levels (State of Vermont, 2015c). The majority of Vermont's GHG emissions is CO_2 as a result 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 (U.S. Energy Information Administration, 2014). Other major GHGs emitted in Vermont are nitrous oxides (NO_x) from fossil fuel combustion and methane (CH_4) from the agricultural sector. Very small quantities of hydrofluorocarbons, sulfur hexafluoride (SF6) and perfluorocarbons (PFCs) are emitted by the industrial and electric power sectors (State of Vermont, 2015c).

Although Vermont does not produce or refine petroleum, petroleum contributes to the majority of emissions in the residential, commercial, and industrial sectors. Energy usage in the state is largely attributed to transportation and heating during the cold winters. Fuel costs in Vermont have risen in the past 10 years and as a result, the state created new policies designed to improve efficiency in residential and business buildings. As a result, between 2005 and 2007 there were significant declines in total fuel combusted all sectors. These improvements can also be attributed to changing weather patterns and improved heating system efficiency (State of Vermont, 2010a). In 2014, 27 percent of Vermont's net electricity generation came from renewable resources, and the remainder from nuclear power, therefore its electric power-related CO_2 emissions until 2015 were virtually zero. Yankee Nuclear Power Plant, which provided 55 percent of Vermont's electricity, was shut down in 2014, which may change the future emissions mix (U.S. Energy Information Administration, 2015b).

Because the rural population often drives long distances, two-thirds of Vermont's petroleum is consumed by the transportation sector. In the early 2000s there was a sharp spike in fuel prices from an unusually cold winter that froze the rivers and delayed fuel deliveries. As a result, the state saw a decrease in GHG emissions between 2005 and 2008 (U.S. Energy Information Administration, 2015b). Since then, Vermont's transportation emissions have continued to decrease which was likely due to an increased support of public transit use, carpooling, alternate fuel vehicles and, new technology (State of Vermont, 2010a).

Vermont's continues to work towards deceasing its GHG emissions by expanding the use of renewable resources for heating and electricity. The state is currently working on several projects involving hydroelectric dams and solar power (U.S. Energy Information Administration, 2014). Vermont has a voluntary goal of obtaining 25% of electricity consumed in the state from renewable energy resources by 2017, a goal Vermont has already achieved (U.S. Energy Information Administration, 2015b).

14.1.14.4. Environmental Setting: Existing Climate

The National Weather Service defines climate as the "reoccurring average weather found in any particular place" (National Weather Service, 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" (National Weather Service, 2011a). The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly temperature characteristics (National Weather Service, 2011b).

The state of Vermont falls into climate group (D) (see Figure 14.1.14-2). Climates classified as (D) are “moist continental mid-latitudinal climates,” with “warm to cool summers and cold winters” (National Weather Service, 2011a) (National Weather Service, 2011b). 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” (National Weather Service, 2011a) (National Weather Service, 2011b). Winter months in (D) climate zones are cold and severe with “snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses” (National Weather Service, 2011a) (National Weather Service, 2011b).

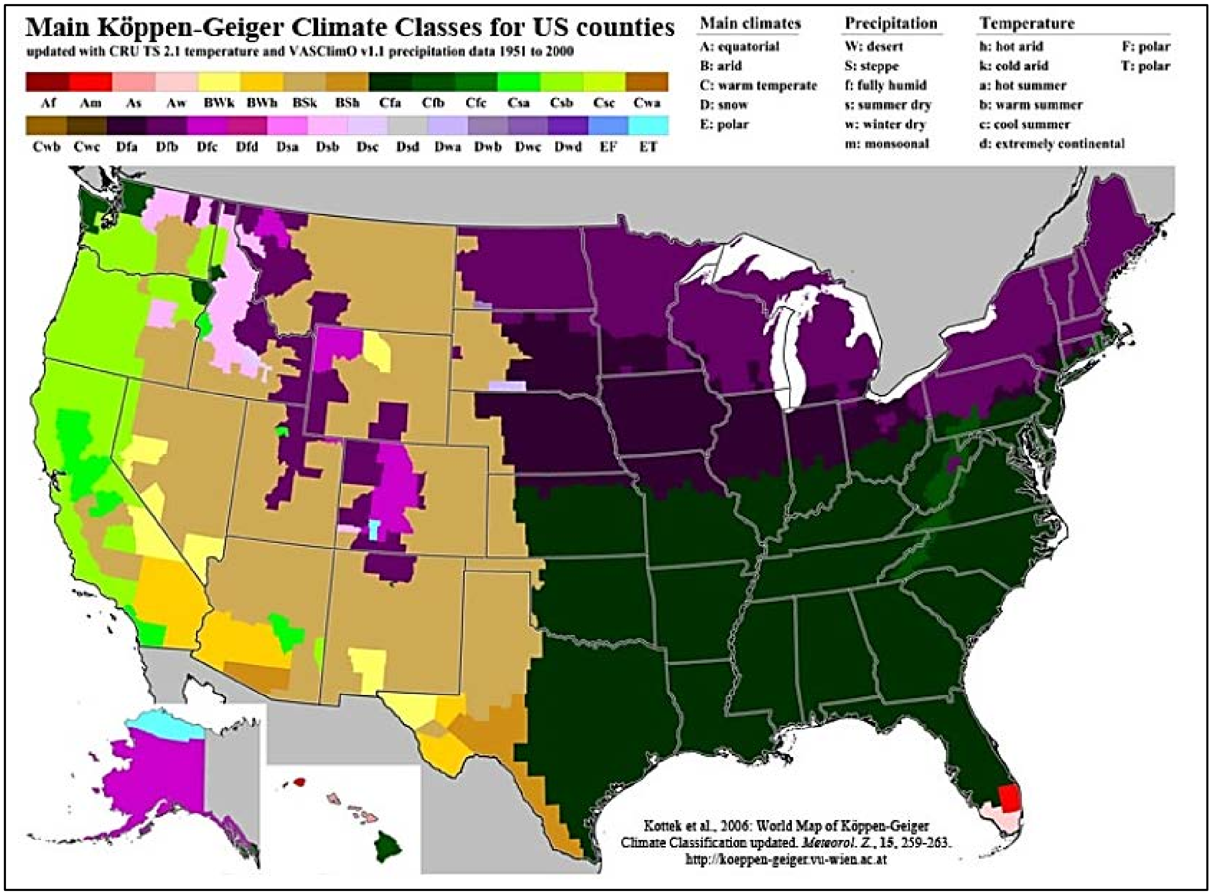

Figure 14.1.14-2: Köppen-Geiger Climate Classes for US Counties

Source: (Kottek, 2006)

This section discusses the current state of Vermont’s climate with regard to air temperature, precipitation, and extreme weather events (e.g., blizzards and hurricanes) in Vermont’s climate region (Dfb).

Vermont has four distinct seasons: winter, spring, summer, and autumn with a “humid, continental climate,” meaning precipitation is often year round (Dupigny-Giroux, 2015). In

Vermont, "weather regime alternates between fair, overcast, and stormy conditions" (Dupigny-Giroux, 2015). Despite this constant variability, tornadoes and hurricanes[140] occur infrequently. Conditions in Vermont also vary from year to year and from season to season (Dupigny-Giroux, 2015). Variables such as geography, topography, elevation, proximity to waterways, and urbanization all affect the local climate in Vermont. "Wind patterns also influence the state's weather and climate" (Dupigny-Giroux, 2015). In addition, Vermont is located "in the zone of the prevailing westerlies,"[141] and "at the exit region of a number of air trajectories[142] across North America" (Dupigny-Giroux, 2015). As a result, Vermont is subjected to "cold, dry air from the North American subarctic; warm, moist air from the Gulf of Mexico; and cool, damp air from the North Atlantic Ocean" (Dupigny-Giroux, 2015). As these air systems converge with prevailing westerlies, storm systems are generated (Dupigny-Giroux, 2015).

Autumn is considered the most pleasant of the four seasons in Vermont. Temperatures during autumn are typically cool, "with average temperatures during the day ranging in the 50s" (Dupigny-Giroux, 2015). Temperature lows during autumn months can "sink to below-freezing" (Dupigny-Giroux, 2015). Summers are typically dry, with moderate temperatures and precipitation. During spring months (March – April), temperature "fluctuations from warm spring days to cold nights will be marked by sap flow" from sugar maple trees; the sugaring season[143] is an indication of spring (Dupigny-Giroux, 2015).

Sub-Climates

Vermont has one sub-climate, as described below.

Dfb – The entirety of Vermont is classified as (Dfb). Climates classified as (Dfb) are characterized as humid, with warm summers and snowy winters (see Figure 3.14.4-1). Vermont's secondary classification indicates substantial precipitation during all seasons. Vermont's tertiary classification indicates that at least four months out of the year averaging above 50 °F (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006) (National Weather Service, 2011a) (National Weather Service, 2011b).

Air Temperature

Vermont has one sub-climate, as described below.

Dfb – Statewide, the average annual temperature is approximately 41.3 °F (National Oceanic and Atmospheric Administration, 2015b). There are slight average temperature differences between northern, western, and southeastern regions of the state. The average annual temperature is approximately 40.2 °F within the northern region, 42.3 °F within the western region, and 42.4 °F within the southeastern region of the state (National Oceanic and Atmospheric Administration, 2015b). The average annual temperature in Montpelier, located in northern Vermont, is 44.4 °F;

[140] Hurricanes are often downgraded to tropical storms as they move northward along the U.S. east coast and wind speeds decrease. However, Vermont is subject to extreme weather, such as Tropical Storm Irene, which caused major flooding throughout the state in 2011 (Vermont Agency of Natural Resources, 2015b).
[141] Westerlies are prevailing winds from the west toward the east in the middle latitudes between 30 and 60 degrees latitude.
[142] The ending point of a jet stream.
[143] The general season when maple syrup can be harvested from maple trees.

19.1 °F during winter months; 68.1 °F during summer months; 42.2 °F during spring months; and 47.5 °F during autumn months[144] (National Oceanic and Atmospheric Administration, 2015c). The highest temperature to occur in Vermont was on July 7, 1912 with a record high of 107 °F (State Climate Extremes Committee, 2015). The lowest temperature to occur in Vermont was on December 30, 1933 with a record low of negative 50 °F (State Climate Extremes Committee, 2015).

Precipitation

Vermont has one sub-climate, as described below.

Dfb – Precipitation throughout Vermont is abundant, with no distinct wet or dry seasons. "Although in the northern and western sections of the state the winter amounts [of precipitation] are somewhat less than those observed during the summer" (Vermont State Climate Office, 2015). Precipitation in southeastern Vermont is directly influenced by the North Atlantic Ocean. Influence from the ocean grows weaker "with increasing distance from the ocean" (Vermont State Climate Office, 2015). "Most of the precipitation is generated by frontal systems" (Vermont State Climate Office, 2015). "During the summer, thunderstorms are responsible for the heaviest local rainfall intensities" (Vermont State Climate Office, 2015). Total annual average precipitation is approximately 41.73 inches in Vermont (National Oceanic and Atmospheric Administration, 2015b). The average annual precipitation accumulation in Montpelier is approximately 42.42 inches; 9.02 inches during winter months; 12.60 inches during summer months; 9.87 inches during spring months; and 10.93 inches during autumn months (National Oceanic and Atmospheric Administration, 2015c). The greatest 24-hour precipitation accumulation occurred on September 17, 1999 with a total of 9.92 inches in Mount Mansfield (State Climate Extremes Committee, 2015).

"Freezing rain occasionally occurs, sometimes more than once per winter in certain regions" (Vermont State Climate Office, 2015). During one particular freezing rain event in January of 1998, approximately "2.11 inches of rain were received on January 8, 1998 at the peak of this ice storm" (Vermont State Climate Office, 2015). Vermont's current daily record is "8.77 inches on November 3 to 4, at Somerset during the 1927 flood" (Vermont State Climate Office, 2015). The greatest hail weight, circumference, and diameter occurred on July 16, 2009 with a total of 2.1 ounces, 6.8 inches, and 3.3 inches respectively (State Climate Extremes Committee, 2015).

In addition to rainfall and freezing rain, snowfall is also abundant in Vermont. "Yearly snowfall totals vary except along parts of the Connecticut River Valley and the western division where typical values range from 55 to 60 inches" (Vermont State Climate Office, 2015). Snowfall averages and totals also vary greatly with elevations over short distances. "During most winters, several snowstorms of five inches or more are to be expected" (Vermont State Climate Office, 2015). The highest snowfall accumulation occurred on February 5, 1995 with a record total of 42 inches in Jay Peak (State Climate Extremes Committee, 2015).

[144] Cities within the regions of Vermont can vary in temperature.

Sea Level

The state of Vermont does not have any coastal or tidal miles. Therefore, Vermont is not impacted by global sea level rise.

Severe Weather Events

Although severe flooding in Vermont is infrequent, a few significant and destructive storms have occurred. In November 1927, the Great Vermont Flood caused 84 deaths, hundreds of injuries, the destruction of 1,285 bridges, and approximately $450 million dollars' worth of damage (adjusted for 2012 inflation) (National Weather Service, 2015a). This flood "stands as the greatest natural disaster in Vermont history" (National Weather Service, 2015a). "Rainfall during the month of October averaged about 150 percent of normal across the state" (National Weather Service, 2015a). Some stations in northern and central regions of the state received 200 to 300 percent of normal. Although the October rainfall did not cause flooding, the rain did cause "the soil to become saturated" (National Weather Service, 2015a). Rainfall began on November 2, and increased in intensity through November 3 "as a low pressure center moved up along the northeast coast" (National Weather Service, 2015a). "This low had copious moisture associated with the remnants of a former tropical storm" (National Weather Service, 2015a). "Rainfall amounts at the Weather Bureau station in Northfield totaled 1.65 inches from 4 am to 11 am on the 3rd, with 4.24 inches falling from 11 am to 8 pm" (National Weather Service, 2015a). The total rainfall accumulation between November 2nd and 4th was 8.71 inches (National Weather Service, 2015a). Although much of the state was devastated, "the hardest hit area was most likely Winooski Valley," where a large majority of the population lived (National Weather Service, 2015a).

In August 2011, Tropical Storm Irene caused approximately $700 million worth in damages, the destruction of 3,500 homes, 500 miles of roadway, 1,200 bridges, and 629 cultural sites (National Weather Service, 2015a). "While Irene's winds were only moderately strong in Vermont, the storm produced tremendous amounts of rainfall which led to devastating flooding" (National Weather Service, 2015a). Central and southern Vermont was hit the hardest, with a total precipitation accumulation of four to eight inches across the Green Mountains within an 18-hour period. "In some cases, the flooding from Irene was worse than the Great Flood of 1927, with all-time record crests observed on the Walloomsac River at North Bennington, [Vermont] and the Otter Creek at Center Rutland, [Vermont]" (National Weather Service, 2015a). In total, Tropical Storm Irene caused approximately $700 million in damages to public infrastructure and property. Tropical Storm Irene is considered "the second greatest natural disaster in Vermont's history" (National Weather Service, 2015a).

"Blizzards of a variety of magnitudes have been observed, ranging from the Great Blizzard of 1888 to the Super Storm of 1993" (Vermont State Climate Office, 2015). On February 25, 1969 a total accumulation of 33 inches was recorded in St. Johnsbury. "Many of the more severe blizzards tend to be nor'easters which generate very strong winds, heavy rain, or snow" (Vermont State Climate Office, 2015). Other forms of severe weather (e.g., tornadoes) tend to be less common. The most recent tornado occurred in June 1998, near Bennington (Vermont State Climate Office, 2015).

14.1.15. Human Health and Safety

14.1.15.1. 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 relationship to 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 potential impacts associated with radio frequency (RF) radiation, vehicular traffic, or the transportation of hazardous materials and wastes. Vehicle traffic and transportation are evaluated in Section 14.1.1, Infrastructure.

14.1.15.2. Specific Regulatory Considerations

Federal organizations, such as OSHA, USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. The Vermont Department of Environmental Conservation, within the Vermont Agency of Natural Resources, manages water and air quality; regulates solid and hazardous wastes; and administers a number of voluntary pollution and waste reduction programs (Vermont Department of Environmental Conservation, 2015b). In 1972, following federal legislation, the State of Vermont established the Vermont Occupational Safety and Health Administration (VOSHA) within the Vermont Department of Labor, Workers' Compensation, and Safety Division. Vermont's state plan applies to all workers, with the exception of federal government workers, the United States Postal Service, private sector maritime activities (shipyard employment, marine terminals, and long shoring), and military bases, who are subject to federal jurisdiction. VOSHA has adopted most OSHA standards by reference, but has established additional state-specific standards for permissible exposure limits and line worker safety. The line worker safety standards apply to the maintenance, operations, alterations, and removal of electric transmission and distribution line and equipment (Occupational Safety and Health Administration, 2015a).

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C. Table 14.1.15-1 below summarizes the major Vermont laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 14.1.15-1: Relevant Vermont Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Vermont Safety and Health Standards for General Industry, Section 1910.1000	Vermont Department of Labor, Vermont Occupational Safety and Health Administration	Establishes employee exposure limits to substances listed within the section.
Mandatory Appendix A-1 to Federal OSHA regulations (29 CFR 1910.269)	Vermont Department of Labor, Vermont Occupational Safety and Health Administration	Establishes requirements regarding personnel conducting maintenance, operations, alterations, and removal of electric transmission and distribution line and equipment.
Title 10 : Conservation And Development Chapter 159: Waste Management	Vermont ANR	Authorize the state to provide technical and financial leadership to municipalities for the siting of solid waste management facilities, and implements a program for the management and reduction of wastes that over the long term is sustainable, environmentally sound, and economically beneficial, and that encourages innovation and individual responsibility.
Code of Vermont Rules, Agency 12, Sub-Agency 32, Chapter 7	Vermont ANR	Describes state regulations relating to the generation, storage, collection, transport, treatment, disposal, use, reuse, and recycling of hazardous waste in Vermont.
Vermont Statutes, Title 18, Chapter 32	Vermont Department of Health	Describes programs for the control of ionizing and non-ionizing radiation compatible with federal programs for regulating byproduct, source, and special nuclear materials.

14.1.15.3. 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, inside 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 hazards and risks depending on the task, occupational competency, and work-site monitoring (Occupational Safety and Health Administration, 2016a). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

Working from height, overhead work, and slips, trips, or falls – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights up to 2,000 feet above the ground's surface (Occupational Safety and Health Administration, 2015b). In addition to tower climbing hazards, telecommunication workers have restricted workspace on rooftops or work from bucket trucks parked on uneven ground. Cumulatively, these conditions present fall and injury hazards to telecommunication workers, and the general public who may be observing the work or transiting the area.

Trenches and confined spaces – Installation of underground utilities, building foundations, and work in utility manholes[145] are examples of when confined space work is necessary. Installation of telecommunication activities involves laying conduit and in small trenches (generally 6 to 12 inches in width). Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics. (Occupational Safety and Health Administration, 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 may be 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.

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.

Optical fiber safety – Optical fiber cable installation and repair presents additional risks to telecommunications workers, including potential eye or tissue damage, through ingestion, inhalation, or other contact with glass fiber shards. The shards are generated during termination and splicing activities, and can penetrate exposed skin. (International Finance Corporation, 2007) Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation (e.g., manholes) 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 14.1.13, Noise) (Occupational Safety and Health Administration, 2002). Fugitive noise may emanate beyond the telecommunication work site and affect the public living in the vicinity, observing the work, or transiting through the area.

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

[145] 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.

compressed gases used for welding and metal cutting (new towers only). In some cases, telecommunication sites require treatments, such as pesticide application. Secondary hazardous materials, like exhaust fumes, may be a greater health risk than the primary hazardous material (i.e., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. While it is unlikely that any FirstNet activities would involve the generation or storage of hazardous waste, older existing telecommunication structures and sites could have hazardous materials present, such as lead-based (exterior and interior) paint at outdoor structures or asbestos tiles and insulation in equipment sheds. The general public, unless a telecommunication work site allows unrestricted access, are typically shielded from hazardous materials and hazardous wastes that are components of telecommunication site work.

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.

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

Telecommunication Worker Occupational Health and Safety

The BLS uses established industry and occupational codes to classify telecommunications workers. For industry classifications, BLS uses the North American Industry Classification System (NAICS) codes, which identify the telecommunications industry (NAICS code 517XX) as being within the information industry (NAICS code 51). For occupational classifications, BLS uses the Standard Occupational Classification (SOC) system to identify workers as belonging to one of 840 occupations. Telecommunications occupations are identified as either telecommunication equipment installers and repairers (SOC code 49-2022), and telecommunication line installers and repairers (SOC code 49-9052). Both occupations are reported under the installation, maintenance and repair occupations (SOC code 49-0000).

In 2014, Vermont employed 280 Telecommunications Line Installers and Repairers and 600 telecommunications equipment installers and repairers (Bureau of Labor Statistics, 2015b). In 2013, the most recent year that data are available, Vermont did not report any nonfatal occupational injuries or illnesses in the telecommunications industry. However, in 2012, Vermont had 2.6 reportable cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (LeGrande, 2015). By comparison, the same year, there were 1.9 nonfatal occupational injuries or illnesses reported nationwide per 100 full-time workers in the telecommunications industry (Bureau of Labor Statistics, 2012a).

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; and 7 due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (Bureau of Labor Statistics, 2013). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of total occupational fatalities (4,585 total). Vermont has not reported any fatalities in the telecommunications industry or telecommunications occupations since 2003, when data are first available (Bureau of Labor Statistics, 2015c).

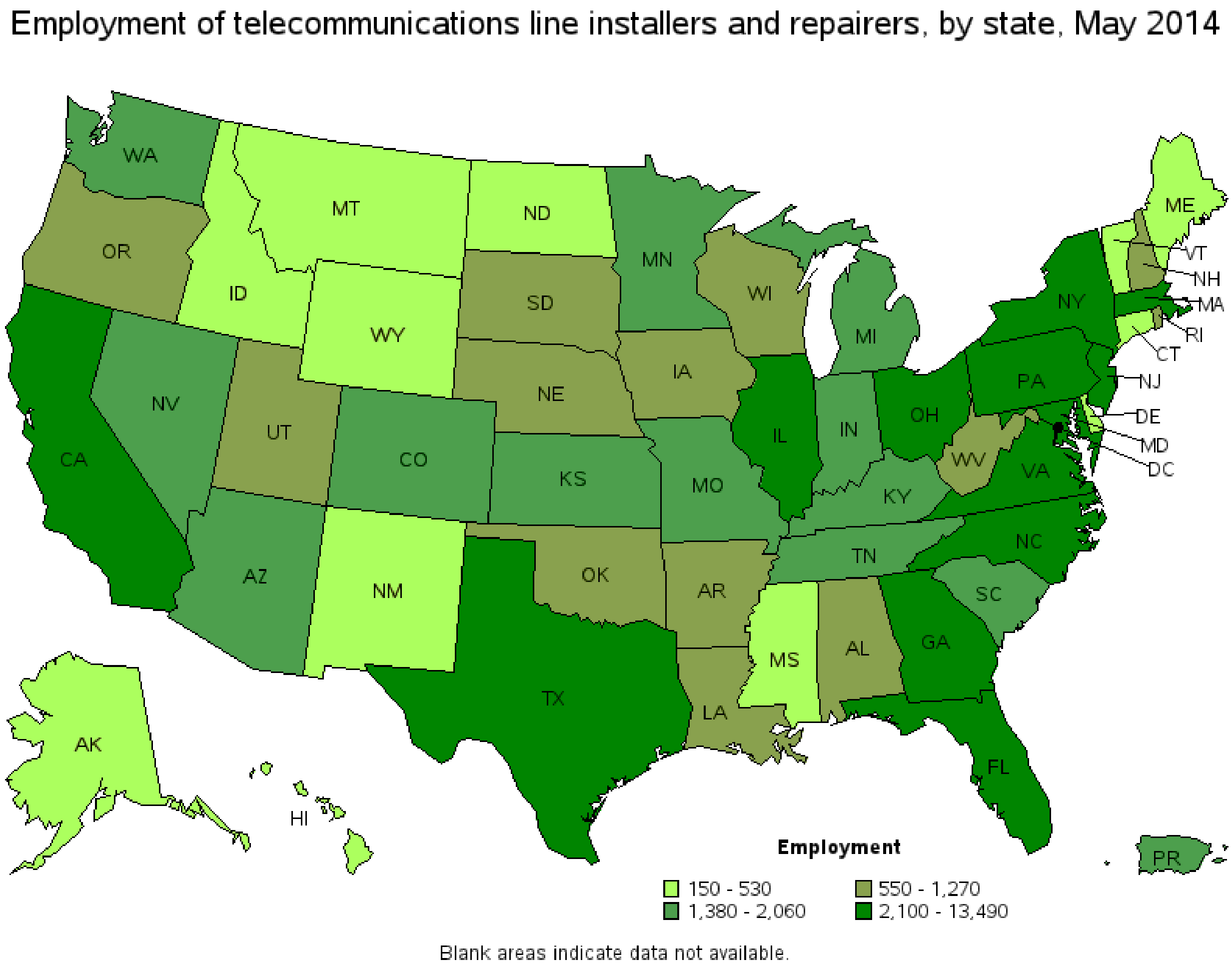

Figure 14.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (Bureau of Labor Statistics, 2015d)

Public Health and Safety

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

14.1.15.4. 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[146] or listed on the National Priorities List (NPL), as well as the Resource Conservation and Recovery Act (RCRA) Corrective Action sites and Brownfields. These regulated cleanup sites are known to contain environmental contaminants at concentrations exceeding acceptable human health exposure thresholds. Contact with high concentrations of contaminated media can result in adverse health effects, such as dermatitis, pulmonary and cardiovascular events, organ disease, central nervous system disruption, birth defects, and cancer. It generally requires extended periods of exposure over a lifetime for the most severe health effects to occur.

In Vermont, the Sites Management Section (SMS) of the Vermont ANR administers the investigation and cleanup of properties contaminated by the release of hazardous materials. The SMS provides this oversight in accordance with 10 V.S.A. Section 6615, and also performs emergency response for hazardous materials spills; issues permits for federal and state programs regulating hazardous wastes, solid wastes, and underground storage tanks; and manages cleanup at hazardous sites under state and federal authorities, including RCRA and CERCLA/Superfund (Vermont Waste Management Division, 2015). As of September 2015, Vermont had 7 RCRA Corrective Action sites,[147] 268 brownfields, and 14 proposed or final Superfund/NPL sites (6 of which are landfills and 3 are mines). Based on a September 2015 search of USEPA's Cleanups in My Community (CIMC) database, Vermont did not have any Superfund or RCRA Corrective Action sites where contamination has been detected at an unsafe level, or a reasonable human exposure risk currently exists, although monitoring of these sites continues (USEPA, 2015j).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility –

[146] 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).

[147] Data gathered using USEPA's CIMC search on September 24, 2015, for all sites in the state of Vermont, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active).

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). Based on the most recent data available, in 2014 Vermont had 38 TRI reporting facilities (USEPA, 2015k). According to the USEPA, in 2014 Vermont released 309,125 pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from the Computers/Electronics Products industry. This accounted for 0.01 percent of total TRI releases nationwide, ranking Vermont 54 of 56 states and territories (USEPA, 2015k).

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, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (National Institute of Health, 2015). Figure 14.1.15-2 provides an overview of potentially hazardous sites in Vermont.

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over water bodies. Indoor air quality may be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation.

According to BLS data, Vermont had four total occupational fatalities in 2012 (Bureau of Labor Statistics, 2012b) and two fatalities in 2011 (Bureau of Labor Statistics, 2011) from exposure to "harmful substances or environments," although no fatalities were reported within the telecommunications industry or occupations. By comparison, the BLS reported three fatalities in 2011 and three "preliminary" fatalities in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (Bureau of Labor Statistics, 2015e). In 2014, BLS also reported four preliminary fatalities within the telecommunications line installers and repairers occupation (SOC code 49-9052), and no fatalities within the telecommunications equipment installers and repairers occupation (SOC code 49-2022) due to exposure to harmful substances or environments (Bureau of Labor Statistics, 2014).

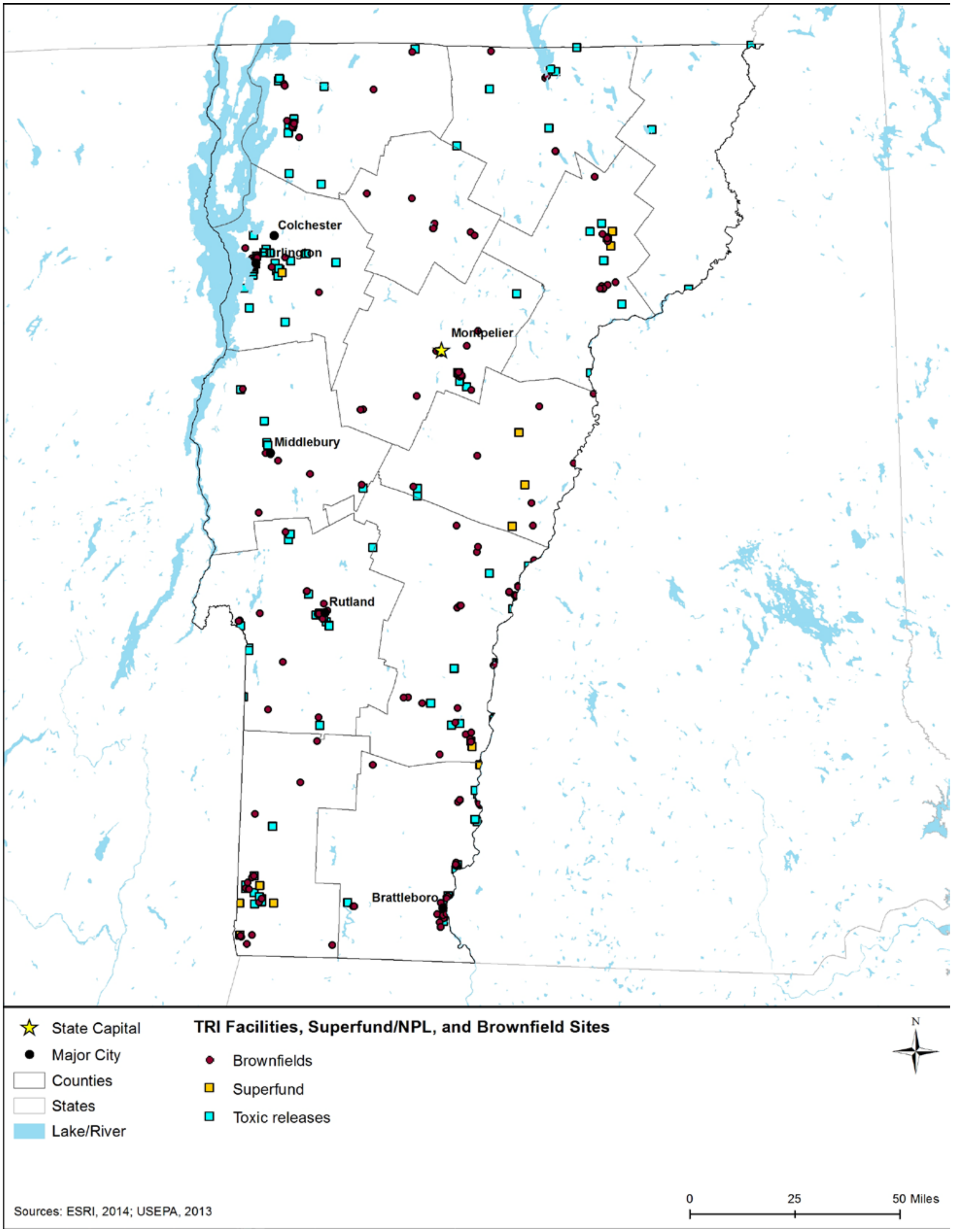

Figure 14.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Vermont

Public Health and Safety

As described earlier, access to telecommunication sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunication sites present an inherent low risk to non-occupational workers, the general public could be potentially exposed to contaminants and other hazards in a variety of ways. One example would be if occupational workers disturb contaminated soil while digging, causing hazardous chemicals to mix with an underlying groundwater drinking water sources. If a contaminant enters a drinking water source, the surrounding community could inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors.

The Vermont Department of Health, along with other government agencies, first responders, communities, hospitals, and health care providers respond to public health emergencies, such as extreme weather events, and releases of biological, chemical, or radiological agents (Vermont Department of Health, 2015). In addition, the Vermont Department of Health is one of 26 states participating in a U.S. Centers for Disease Control and Prevention (CDC)-funded program to develop a network to track environment and health data. The CDC's goal is to develop a tracking system that integrates data about environmental hazards and exposures with data about diseases that may have an environmental link (Vermont Department of Health, 2015).

14.1.15.5. Environmental Setting: Abandoned Mine Lands at or near Telecommunications Sites

In addition to hazardous waste contamination, another health and safety hazard includes surface and subterranean mines. Health and safety hazards known 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, 2015). Gradual settling or sudden sinking of the Earth’s surface, also known as subsidence, presents additional risks and is further discussed in Section 14.1.3, Geology.

Vermont is ranked 23rd of 50 states in terms of the value of nonfuel mineral production and principal nonfuel minerals produced in 2015, which indicates that mining is not a significant sector of the state’s economy (U.S. Department of the Interior, 2014) (U.S. Geological Survey, 2016). Nonetheless, 3 of Vermont’s 14 Superfund sites on the NPL are abandoned copper mines, and are being monitored and remediated by federal and state agencies – Elizabeth Mine in Strafford, VT; Ely Mine in Vershire, VT; and the Pike Hill mine in Corinth, VT (see discussion below). Vermont does not have an AML program, however, the Vermont Department of Environmental Conservation, within the Vermont Agency of Natural Resources, is responsible for environmental hazards, including AMLs and other hazards from mines in the state that could potentially impact existing and future telecommunication sites. As of May 2015, there were also no “high priority” AMLs (sites posing health and safety hazards) in Vermont (U.S. Department of the Interior, 2015).

In 2008, the federal Center for Disease Control, Agency for Toxic Substances and Disease Registry (ATSDR) compiled a report on the abandoned Ely Mine, and concluded that trespassers may encounter onsite physical hazards. The acidity of onsite surface waters could cause skin and eye irritation on contact, as well as skin corrosion. Onsite surface water and groundwater should not be used for drinking water due to acidity and elevated concentrations of metals. In addition, the ATSDR recommended that warning sings be placed near vertical shafts or other potential hazards is recommended and to discourage site access and trespassing (Agency for Toxic Substances and Disease Registry, 2008).

Mine tailings at the Pike Hill Mine site produce sulfuric acid as water passes over, resulting in acid mine drainage to Pike Hill Brook and the Waits River. Other hazards present at this site include the potential risk for fire, due to spontaneous oxidation and combustion of reactive sulfides present in the mine. (USEPA, 2015l)

14.1.15.6. Environmental Setting: Natural & Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the general public. Telecommunications, including public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Floodwaters are often contaminated by hazardous chemicals and sanitary wastes, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (Occupational Safety and Health Administration, 2003).

Physical hazards may also be present at disaster sites, such as downed utility lines, debris blockage or road washout conditions, which increases exposure risks to telecommunication workers. Climbing and working from tower structures damaged by wind increases the risk of slips, trips, or falls. During natural and manmade disasters, access to the telecommunication sites can be obstructed by debris.

Spotlight on Vermont Superfund Sites: Elizabeth Mine

The abandoned Elizabeth Mine is a former copper mine in a rural 850-acre area in Strafford, Orange County, Vermont. Mining began at this site in the late 18th century and continued intermittently until 1958.

According to the USEPA's NPL site description, the property consists of two mine tailings piles (TP-1 and TP-2), one area of waste rock and heap leach piles, two open-cut mines, several adits (horizontal mine entrances), underground shafts and tunnels, ventilation shafts, and several former ore processing buildings. When mining operations ceased in 1958, underground areas flooded with ground water, some of which now leeches to the surface. A former ventilation shaft to underground work areas is currently discharging acidic water to a brook that is a tributary to the West Branch Ompompanoosuc River. Prior to installation of a soil buttress in 2006 to stabilize soil erosion at TP-1, the site was potentially at risk for damaging downstream property and contaminating 20 miles of streams and river (USEPA, 2006b).

The Non-Time-Critical Removal Action is projected to be complete in 2015/2016 after the site restoration activities are complete and the passive treatment system is installed and operational. Current health and safety risks primarily include potential exposure from ingestion or contact with lead-contaminated soil, groundwater, and surface water. (USEPA, 2015m)

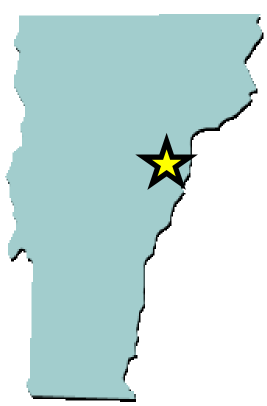

Figure 14.1.15-3*:* Iron Seeps Discharging at Base of TP-1, Elizabeth Mine

Source: (U.S. Geological Survey, 2013c)

Telecommunication Worker Occupational Health and Safety

Telecommunication workers are often early responders to natural and manmade disasters because of the critical need to restore and maintain telecommunication capabilities. The need to enter disaster areas as part of the recovery effort exposes telecommunication workers to elevated risks because chemical, biological, and physical hazards might not have been fully identified or assessed. Transportation infrastructure and utilities in the affected areas are often compromised and present unknown chemical and biologic hazards. Correspondingly, if telecommunication workers are injured during response and repair operations, their rescue and treatment might over-extend staff and medical facilities that are delivering care to victims of the initial incident.

Vermont Department of Labor and BLS do not report data specific to injuries or fatalities among telecommunication workers responding to natural or manmade disasters. However, the National Response Center (NRC), managed by the U.S. Coast Guard, compiles reports for oil spills, chemical releases, or other maritime security incidents and contains incident reports related to occupational health and safety. Of the 54 NRC-reported incidents for Vermont in 2015 with known causes, 4 incidents were attributed to natural disaster (e.g., earthquake, flood, hurricane, tornado, or other natural phenomenon), while 50 incidents were attributed to manmade disasters (e.g., derailment, dumping, equipment failure, operator error, over pressuring, suicide, transport accident, or trespasser) or other indeterminate causes (U.S. Coast Guard, 2015). Such incidents present unique, hazardous challenges to telecommunication workers responding during natural disasters.

Public Health and Safety

Hazards present during natural and manmade disasters are often ubiquitous, affecting large geographic areas and populations living within the areas. Most residents of Vermont live in communities of less than 2,500 (Vermont Chamber of Commerce, 2014). Similar to telecommunication workers, the general public face risks during natural disasters, such as compromised transportation infrastructure and utilities and potential for exposure to unknown chemical and biologic hazards. Infrastructure damage was extensive during Tropical Storm Irene, as described in the spotlight below. In addition, a major winter storm in December 2014 severely damaged Vermont’s infrastructure, including downed power lines. According to FEMA, Vermont received more than $1 million in federal assistance to help with infrastructure repair. Another $2 million in FEMA aid was anticipated, primarily for Vermont Electric Cooperative. “The December storm was a four-day event that caused an estimated $4+ million in damage and response costs,” said State Coordinating Officer Robert Schell with Vermont’s Division of Emergency Management and Homeland Security (Federal Emergency Management Agency, 2015c). In 2014, Vermont experienced no weather-related injuries and no fatalities (National Weather Service, 2015b). For comparison, there were five weather-related fatalities in 2011, the year Tropical Storm Irene affected the northeast (National Weather Service, 2013).

Spotlight on Vermont Natural Disaster Sites: Tropical Storm Irene, August 2011

Climate data show that Vermont is experiencing more extreme rain events, and the trend is predicted to continue. From August 28-29, 2011, Tropical Storm Irene dumped 3-7 inches of rain on the slopes and valleys of Vermont. Floodwaters from the Mad River valley south to the Deerfield River affected 225 municipalities. The flooding forced the state to relocate the disaster response headquarters after the main offices for the Vermont Emergency Management and Vermont Agency of Natural Resources were flooded in Waterbury, VT. More than 500 miles of the state's roads were extensively damaged, and 13 communities across the state were isolated when roads were washed out (Vermont Agency of Natural Resources, 2015b)

Source: (Vermont Agency of Natural Resources, 2015c)

Figure 14.1.15-4: Washout at VT Route 107 (left) and Kerosene Oil Release at Waterbury Mobile Home Park (right)

The National Weather Service (NWS) conducted a service assessment and report addressing the strengths and weaknesses of the NWS during the storm. The report concluded that during Irene, personnel and staff performed consistently well, but technical problems with the communications systems and infrastructure resulted in number of significant problems. For example, during Tropical Storm Irene, four weather forecasting offices in New York/Upton, Burlington, Wilmington, and Newport/Morehead City experienced a loss of their primary data communications (OPSnet). The NWS also found that it was beneficial to collocate weather forecasters with local emergency management partners, enabling timely, customized information to the responders, allowing the responders to make decisions and act with greater confidence to safeguard life and property. (National Weather Service, 2012)

As of November 2011, FEMA had provided more than $45.9 million in grants and loans to Vermont residents, businesses, and non-profit entities, to address loss and damages attributed to Tropical Storm Irene (Federal Emergency Management Agency, 2011).

14.2. 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 Alternative provides a comparison to describe the effects of environmental resources of the existing conditions to the proposed Alternatives.

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

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

14.2.1. Infrastructure

14.2.1.1. Introduction

This section describes potential impacts to infrastructure in Vermont 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.

14.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 14.2.1-1. 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.

14.2.1.3. 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. Based on the impact significance criteria presented in Table 14.2.1-1, 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, short-term 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 14.2.1-1, such potential negative and positive impacts would be less than significant.

Table 14.2.1-1: 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
Modifies existing public safety response, physical infrastructure, telecommunication	Magnitude or Intensity	Substantial adverse changes in public safety response times and the ability to communicate	Effect that is potentially significant, but with mitigation is	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

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
practices, or level of service in a manner that directly affects public safety communication capabilities and response times		effectively with and between public safety entities	less than significant		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
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	Effect that is potentially significant, but with mitigation is	Minor disruptions to the delivery of electric power, water, and sewer services, or minor modifications to physical	There would be no perceptible impacts to delivery of other utilities and no service disruptions.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
		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	less than significant	infrastructure that result in minor disruptions to delivery of power, water, and sewer services	
	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 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 14.2.1-1, 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.[148] 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 14.2.1-1.

Effects to Utilities, including Electric Power Transmission Facilities, and Water and Sewer Facilities

The activities proposed by FirstNet would have less than significant impacts on utilities, including electric power transmission facilities, and water and sewer facilities. Depending on the specific project contemplated, installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on a temporary or permanent basis. Also, depending on the specific project contemplated, the draw or use of power from the

[148] 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.

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.

14.2.1.4. 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 to 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)[149], 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 be no local infrastructure to impact. 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.

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

- 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 not result in impacts to soils. However, if additional power units are needed, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - *Deployable Technologies*: Deployable technologies such as COWs, COLTs, and SOWs are comprised of cellular base stations, sometimes with expandable antenna masts, and generators that connect to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however, this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road ROWs and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation congestion and delays. Implementation of deployable technologies could result in potential impacts to infrastructure resources in terms of infrastructure expansion, if deployment requires paving of previously unpaved surfaces or other new infrastructure build to accommodate the deployable technology. Also, beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Where deployable technologies would be implemented on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, or where aerial deployable technologies may be launched or recovered on existing paved surfaces, it is anticipated that there would be no impacts to infrastructure resources because there would be no disturbance of the natural or built environment.

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. These impacts are expected to be less than significant as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the on-going phase of deployment, and minor. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable and feasible, to avoid or minimize potential impacts.

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

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if further construction related activities are required along public road and utility ROWs, increased traffic congestion, current telecommunication system interruption, and utility interruptions could occur. These potential impacts would be expected to be minor and temporary as explained above. 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 and feasible, to avoid or minimize potential impacts.

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.

14.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[150]

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. 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 and feasible, to avoid or minimize potential impacts.

Operation Impacts

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

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

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 and 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 14.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

14.2.2. Soils

14.2.2.1. Introduction

This section describes potential impacts to soil resources in Vermont 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.

14.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 14.2.2-1. 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.

Table 14.2.2-1: 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

14.2.2.3. 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 Vermont 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 (Natural Resources Conservation Service, 2000). Areas exist in Vermont that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Aqualfs, Aquepts, Cryods, Fluvents, Hemists, Humods, Orthods, Psamments, Udalfs, and Udepts (see Section 14.1.2.4, Soil Suborders, and Figure 14.1.2-2).

Based on the impact significance criteria presented in Table 14.2.2-1, 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 would, where practicable and feasible, be implemented 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 14.2.2-1, 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. 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 14.1.2.4, Soil Suborders). The most compaction susceptible soils in Vermont are hydric soils with poor drainage conditions, which include Aqualfs, Aquepts, and Hemists. These suborders constitute approximately 11 percent of Vermont,[151] and are found throughout the state (see Figure 14.1.2-2). 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 14.2.2-1, 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.

14.2.2.4. 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, 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

[151] 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.

phones, and video cameras, would not impact soil resources because those activities would not require ground disturbance.

Activities with the Potential to Have Impacts

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

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

- Wireless Projects
  - *New Wireless Communication Towers*: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - *Deployable Technologies*: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs) 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. 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 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.

14.2.2.5. 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 no 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. 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 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 14.1.2, Soils.

14.2.3. Geology

14.2.3.1. Introduction

This section describes potential impacts to Vermont 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.

14.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 14.2.3-1. 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.

14.2.3.3. 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, and surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Seismic Hazard

As discussed in Section 14.1.3, Vermont is not at risk to significant earthquake events. As shown in Figure 14.1.3-6, northwestern Vermont is at greatest risk to earthquakes, though no earthquake over magnitude 5.0 on the Richter scale has ever been recorded in the state. Based on the impact significance criteria presented in Table 14.2.3-1, seismic impacts would not be potentially significant if FirstNet's deployment locations were within high-risk earthquake hazard zones or active fault zones. Given the potential for minor to moderate earthquakes in parts of Vermont, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Landslides

As discussed in Section 14.1.3, portions of Vermont are at high risk of experiencing landslide events. Vermont is particularly susceptible to landslides along its western border with New York. Based on the impact significance criteria presented in Table 14.2.3-1 impacts from landslides could be potentially significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that several of Vermont's major cities, including Montpelier, Burlington, and Colchester, are in areas that are highly susceptible to landslides, some amount of infrastructure could be subject to landslide hazards, in which case BMPs and mitigation measures (see Chapter 17) could help avoid or minimize the potential impacts.

Table 14.2.3-1: Impact Significance Rating Criteria for Geology

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMP and Mitigation Measures Incorporated	Less than Significant	No Impact
Seismic Hazard	Magnitude or Intensity	High likelihood that a project activity could be located within a high-risk earthquake hazard zone or active fault	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located within an earthquake hazard zone or active fault	No likelihood of a project activity being located in an earthquake hazard zone or active fault
	Geographic Extent	Hazard zones or active faults are highly prevalent within the state/territory		Earthquake hazard zones or active faults occur within the state/territory, but may be avoidable	Earthquake hazard zones or active faults do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
Volcanic Activity	Magnitude or Intensity	High likelihood that a project activity could be located near a volcano lava or mud flow area of influence	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located near a volcanic ash area of influence	No likelihood of a project activity located within a volcano hazard zone
	Geographic Extent	Volcano lava flow areas of influence are highly prevalent within the state/territory		Volcano ash areas of influence occur within the state/territory, but may be avoidable	Volcano hazard zones do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
Landslide	Magnitude or Intensity	High likelihood that a project activity could be located within a landslide area	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located within a landslide area	No likelihood of a project activity located within a landslide hazard area
	Geographic Extent	Landslide areas are highly prevalent within the state/territory		Landslide areas occur within the state/territory, but may be avoidable	Landslide hazard areas do not occur within the state/territory

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMP and Mitigation Measures Incorporated	Less than Significant	No Impact
	Duration or Frequency	NA		NA	NA
Land Subsidence	Magnitude or Intensity	High likelihood that a project activity could be located within an area with a hazard for subsidence (e.g., karst terrain)	Effect that is potentially significant, but with mitigation is less than significant	Low likelihood that a project activity could be located within an area with a hazard for subsidence	Project activity located outside an area with a hazard for subsidence
	Geographic Extent	Areas with a high hazard for subsidence (e.g., karst terrain) are highly prevalent within the state/territory		Areas with a high hazard for subsidence occur within the state/territory, but may be avoidable	Areas with a high hazard for subsidence do not occur within the state/territory
	Duration or Frequency	NA		NA	NA
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 BMP 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

Mineral and Fossil Fuel Resource Impacts

As discussed in Section 14.1.3.7, shown on Figure 14.1.3-3 portions of Vermont contain mineral resources. Equipment deployment near mineral and fossil fuel resources are not likely to affect these resources. Rather the new construction is only likely to limit access to extraction of these resources. Based on the impact significance criteria presented in Table 14.2.3-1 impacts to mineral and fossil fuel are unlikely as the Proposed Action could only be potentially significant if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. 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 14.2.3-1 impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 14.1.3.6, fossils are abundant throughout parts of Vermont. 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) may be required 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 14.2.3-1 impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and less than significant as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures (see Chapter 17) could be implemented to help avoid or minimize the potential impacts.

14.2.3.4. 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

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 to 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 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, minor earthquakes, or land subsidence, 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, minor 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 specific geologic hazards (e.g., land subsidence, landslides, or minor earthquakes), it is possible that they could be affected by that hazard.

- Wireless Projects
  - *New Wireless Communication Towers*: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or perturbation of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground

disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.

- *Deployable Technologies*: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs) 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. 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 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.

14.2.3.5. 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 no 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 14.2.3, Geology.

14.2.4. Water Resources

14.2.4.1. Introduction

This section describes potential impacts to water resources in Vermont 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.

14.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 14.2.4-1. 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.

14.2.4.3. 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 Clean Water Act (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 Vermont's rivers and streams are in good condition (7 percent are impaired), although approximately 87 percent of Vermont's lakes, ponds, and reservoirs are impaired (see Table 14.1.4-2 and Figure 14.1.4-2). The main sources of impairment come from atmospheric deposition, channel instability and streambank erosion (including subsequent loss of riparian vegetation), urban land and agricultural runoff, and changes in hydrology, and hydroelectric and snowmaking facilities. A statewide consumption advisory for freshwater fish is in place throughout Vermont due to elevated concentrations of mercury found in fish tissue, as well as polychlorinated biphenyls found in fish tissue in Lake Champlain. (DEC, 2014a)

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, water volume flows, pH or dissolved oxygen levels, water odor, color, or taste, or addition of suspended solids.

Soil erosion or the introduction of suspended solids into waterways from implementation of the Preferred Alternative could contribute to degradation of water quality. If the Proposed Action and Alternatives would disturb more than 1 acre of soil, a state or USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Table 14.2.4-1: 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

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 14.2.4-1, 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[152] 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 Vermont 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 Vermont aquifers, there is little 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 14.2.4-1, 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,

[152] 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).

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 14.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet's likely deployment activities, on the watershed or subwatershed level, would occur inside the 500-year floodplain, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede or redirect flood flows or impact floodplain hydrology, and would not occur during flood events, with the exception of deployable technologies which may be deployed in response to an emergency. Additionally, any effects would be temporary, lasting no more than one season or water year,[153] 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 would 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 14.2.4-1, 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.

[153] 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." (U.S. Geological Survey, 2014f)

- Activities designed so that the amount of stormwater generated before construction is the same as afterwards.
- Activities designed using low impact development techniques for stormwater.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term; impacts to drainage patterns would be less than significant. BMPs, mitigation measures, 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 14.2.4-1. 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 but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns offsite or into surface water bodies that have not received that volume of stormwater before.
- Minor clearing or grading activities.
- Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be less than significant impacts to flow alteration. BMPs, mitigation measures, and avoidance could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 14.1.4.7, approximately half of Vermont's population depends on groundwater for their drinking water supply (Cotton & Butterfield, 1987). The quantity and quality of the state's groundwater supply varies, but is overall suitable for most uses. Groundwater is an important natural resource used for drinking water, agriculture, commercial and manufacturing uses, and in supporting habitat for aquatic life. (DEC, 2015s) Once a groundwater supply is exhausted or contaminated, it is very expensive, and sometimes impossible, to replace. Water supply demand from the deployment activities is unlikely to exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would be unlikely to cause any impacts to water quality. 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.

Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).

Deployment activities should be less than significant since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. The siting of deployment activities should be considered to avoid areas that would extract groundwater from potable groundwater sources in the area. According to Table 14.2.4-1, 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.

14.2.4.4. 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, 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 (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 to 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 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.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure would likely be less than significant due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is complete. BMPs to help mitigate or reduce any potential impacts are described in Chapter 17. 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, 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 deployment 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.

14.2.4.5. 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 no 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. 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. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 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 (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 14.1.4, Water Resources.

14.2.5. Wetlands

14.2.5.1. Introduction

This section describes potential impacts to wetlands in Vermont associated with construction/deployment and operation of the Proposed Action and Alternatives. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

14.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 14.2.5-1. 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.

Table 14.2.5-1: Impact Significance Rating Criteria for Wetlands

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct wetland loss (fill or conversion to non-wetland)	Magnitude or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 404 of the CWA	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No direct loss of wetlands.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality degradation (spills or sedimentation)	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA

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	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.

14.2.5.3. Description of Environmental Concerns

Potential Direct Wetland Loss (Fill or Conversion to Non-Wetland)

Construction-related impacts from several of the deployment activities have the potential for direct wetland impacts such as filling, draining, or conversion to a non-wetland. Examples include placement of fill in a wetland to construct a new tower, trenching through a wetland or directly connected waterway to install a cable, and placement of a structure (tower, building) within the wetland.

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, light, and other human disturbance. To the extent practicable or feasible, FirstNet and/or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 17). Vermont has approximately 300,000 acres of wetlands (DEC, 2015u). In Vermont, the two main types of wetlands are palustrine (freshwater) wetlands found along river and lake floodplains across the state, and lacustrine wetlands found near lakes and ponds (as shown in Figure 14.1.5-1) (DEC, 2014b).

Based on the impact significance criteria presented in 14.2.5-1 and given the temporary nature of most proposed activities, the deployment activities would most likely have less than significant direct impacts on wetlands.

As discussed in Section 14.1.5.2, Wetlands, the Vermont Wetland Rules were passed in 2010 to provide additional protection to “significant wetlands.” Significant wetlands are those identified by the Nongame and Natural Heritage Program of the Vermont Fish and Wildlife has being high quality examples of one of Vermont’s recognized natural community types. Examples include: common wetland deep bulrush marsh, cattail marsh, northern white cedar swamp, red maple black ash seepage swamp, and spruce fir tamarack swamp, along with more rare wetland types such as red maple black gum swamp, alpine peatland, dwarf shrub bog, and rich fen. (Vermont Natural Resources Board, 2010) These rules outline 10 functions and values that comprise significant wetlands, and establish a three-tier system of classification. Class I and Class II wetlands are considered significant, and they, along with their buffer zones (100 feet for Class I and 50 feet for Class II), are protected under the Vermont Wetland Rules. Permits in these areas are only issued if Vermont’s state conservation agency determines that the activity or use will not have adverse impacts on the protected function, unless the impacts can be mitigated. (DEC, 2014b)

If any of the proposed deployment activities that involve ground disturbing 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 14.2.5-1, 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.

Examples of activities that could have other direct effects to wetlands in Vermont 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 Soil Changes:* Changes in soil chemistry can lead to degradation of wetlands that have a specific pH range and/or other parameter, such as the acidic conditions of sphagnum bogs and alkaline conditions of calcareous fens (which are high quality wetlands in Vermont).
- *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:[154] Change in Function(s)[155] 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 could divert 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 could be further reduced by implementing BMPs and mitigation measures (see Chapter 17).

Examples of functions related to wetlands in Vermont 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.

According to the significance criteria defined in Table 14.2.5-1, 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

[154] 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

[155] 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.

significant. Since the majority of the 300,000 acres of wetlands in Vermont 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 could help to mitigate impacts.

14.2.5.4. 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.
- Satellites and Other Technologies
  - *Satellite-Enabled Devices and Equipment:* It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launches for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.

- *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact to 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 shoreline environments.
    - *New Build – Aerial Fiber Optic Plant:* Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
    - *Collocation on Existing Aerial Fiber Optic Plant:* Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.
    - *Installation of Optical Transmission or Centralized Transmission Equipment:* If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near

wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
    - *New Wireless Communication Towers:* Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
    - *Collocation on Existing Wireless Tower, Structure, or Building:* Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
    - *Deployable Technologies:* Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, 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.

14.2.5.5. 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 no 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 Deployed 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 14.1.5, Wetlands.

14.2.6. Biological Resources

14.2.6.1. Introduction

This Chapter describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Vermont associated with deployment and operation of the Proposed Action and its alternatives. Chapter 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

14.2.6.2. 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 14.2.6-1. 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 terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 14.2.6.3, 14.2.6.4, and 14.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 14.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Vermont.

14.2.6.3. Terrestrial Vegetation

Potential impacts to terrestrial vegetation occurring in Vermont 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 14.2.6-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale. The implementation of BMPs and mitigation measures and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat.

Table 14.2.6-1: 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 Mitigation Incorporated	Less than Significant	No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injure/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: MBTA, and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is potentially significant, but with mitigation is less than significant.	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed within Vermont 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	Impact Level: Less than Significant with Mitigation Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: 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 Vermont 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 Mitigation 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: MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic disturbances are measurable but minimal as determined by individual behavior and propagation, and the potential for habituation or adaptability is high given time.	No stress or avoidance of feeding or important habitat areas. No reduced population resulting from habitat abandonment.
	Geographic Extent	Regional or site specific effects observed within Vermont for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience and activity.		Effects realized at one location.	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with Mitigation Incorporated	Less than Significant	No Impact
	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: MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Temporary loss of migratory rest stops due to anthropogenic activities take place in important habitat that is widely distributed and there are no cumulative effects from additional projects.	No alteration of migratory pathways, no stress or avoidance of migratory paths/patterns due to project.
	Geographic Extent	Regional effects observed within Vermont for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with Mitigation Incorporated	Less than Significant	No Impact
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MBTA, and BGEPA.	Effect that is potentially significant, but with mitigation is less than significant.	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success.
	Geographic Extent	Regional effects observed within Vermont for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning, or anthropogenic disturbances that lead to stress, abandonment and loss of productivity for endemics or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated or short-term effects that are reversed within one breeding season.	NA

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Incorporated**	**Less than Significant**	**No Impact**
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with mitigation is less than significant.	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout Vermont.		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

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. Further, if proposed sites with sensitive or rare regional vegetative communities are unavoidable, BMPs and mitigation measures would be recommended to minimize or avoid potential impacts.

Indirect Injury/Mortality

"Indirect effects" are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality can include stress related to disturbance. The alteration of soils or hydrology within a localized area can result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to the small size of expected FirstNet activities. Increasing or decreasing hydrology in an area, as an indirect effect, could lead to moisture stress and/or mortality of plant species that are adapted to specific hydrologic regimes. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment, though BMPs and mitigation measures could help to minimize or avoid the potential impacts.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for terrestrial vegetation (e.g., forest migration) are expected as a result of the Proposed Action given the small-scale of deployment activities.

Reproductive Effects

No reproductive effects to terrestrial vegetation are expected as a result of the Proposed Action given the small-scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species can have a dramatic effect on natural resources and biodiversity.

When non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. Natural or native community species evolve together into an ecosystem with many checks and balances that limit the population growth of any one species. These checks and balances include such things as: predators, herbivores, diseases, parasites, and other organisms competing for the same resources and limiting environmental factors. However, when an organism is introduced into an ecosystem in which it did not evolve naturally, those limits may not exist and its numbers can sometimes dramatically increase. The unnaturally large population numbers can then have severe impacts to the environment, local economy, and human health. Invasive species can out-compete the native species for food and habitats and sometimes even cause their extinction. Even if natives are not completely eliminated, the ecosystem often becomes much less diverse.

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[156], and the nature as well as the extent of the habitats affected.

Activities Likely to Have No Impacts

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

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant:* Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - *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

[156] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

- *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 to 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 right-of-ways (ROWs) or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to terrestrial vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - *Collocation on Existing Aerial Fiber Optic Plant*: Land clearing and excavation during replacement of poles and structural hardening could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - *New Build – Submarine Fiber Optic Plant*: The installation of cables in limited nearshore and inland bodies of water would not impact terrestrial vegetation. However, impacts to

terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.

- *Installation of Optical Transmission or Centralized Transmission Equipment*: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct or indirect injury to plants, the vegetation loss, and invasive species effects.

- Wireless Projects
  - *New Wireless Communication Towers or Backhaul Equipment*: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads), microwave facilities, or access roads could result in impacts to terrestrial vegetation. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to terrestrial vegetation. However, if new power units, replacement towers, structural hardening, and physical security measures require land clearing or excavation activities, impacts would be similar to new wireless construction.
  - *Deployable Technologies*: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct impacts to terrestrial vegetation if deployment occurs on vegetated areas, or the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact terrestrial vegetation if launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs.

    Deployment of drones, balloons, blimps or piloted aircraft could potentially impact terrestrial vegetation if launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs

In general the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the vegetation affected. These impacts are expected to be less than significant due to the small-scale of expected deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, *Proposed Action Infrastructure*, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in less than significant effects due to the small-scale of expected activities. These potential impacts could result from accidental spills from maintenance equipment or release of herbicides and because these areas would not be allowed to revert to a more natural state. If usage of heavy equipment or land clearing activities occurs off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species could occur to terrestrial vegetation, however impacts are expected to be less than significant due to the small-scale of expected activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no 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.

Operation 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 14.1.6.3, Terrestrial Vegetation.

14.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in Vermont 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 14.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of the proposed deployment activities. Although anthropogenic disturbances may be measurable (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 Vermont. 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 (DOT, 2015g). Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur.

Entanglement in fences or other barriers could be a source of mortality or injury to terrestrial mammals, though entanglements would likely be isolated, individual events.

If bats, and particularly maternity colonies are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small-scale and would be dependent on the location and type of deployment activity, and the amount of tree removal. Site avoidance measures could be implemented to avoid disturbance to bats.

<u>Birds</u>

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 night-migrating birds, "poor" fliers (e.g., ducks), night-migrating birds, heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (Gehring, J., Kerlinger, P. and A. 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. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997). Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small-scale of likely FirstNet actions.

Direct mortality and injury to birds of Vermont 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 could be 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 Vermont's amphibian and reptile species are widely distributed throughout Vermont. However, some species occur in limited locations within the state. 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.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Vermont 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.

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 Vermont's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Vermont and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., black bear, white-tailed deer, moose) 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 and medium-sized mammals (e.g., bats, lynx, bobcat) 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.

Birds

The direct removal of most bird nests is prohibited under the MTBA. The USFWS can provide regional guidance on the most critical time periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation can affect avian species directly by loss of nesting, foraging, stopover, and cover habitat.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced if birds temporarily avoid IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[157] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration can have major impacts to species that migrate in large flocks and concentrate at stop overs (e.g., shorebirds). BMPs and mitigation measures, including nest avoidance during construction-related activities, could help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for Vermont's amphibians and reptiles typically consist of wetlands and, in some cases as with the timber rattlesnake (*Crotalus horridus*), the surrounding upland forest. Impacts are expected to be less than significant. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 17) would be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 14.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed

[157]Passerines are an order of "perching" birds that have four toes, three facing forward and one backward, which allows the bird to easily cling to both horizontal and nearly vertical perches.

Action may also have effects to Vermont's amphibian and reptile populations, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.[158]

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 14.2.6.6, 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 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.

Birds

Repeated disturbance, especially during the breeding and nesting season, can cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, 1997). The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, can cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

[158] See Section 3.2.5, Wetlands, for a discussion of BMPs for wetlands.

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 Vermont's amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below.

Terrestrial Mammals

Large game animals (e.g., moose) 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 (e.g., bats) also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula.[159] 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. 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.

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 Vermont undertake some of the longest-distance migrations of all animals. Vermont is located within the Atlantic Flyway, which spans more than 3,000 miles from the Arctic tundra to the Caribbean. Vermont has 17 IBAs and 4 IBA complexes that include important breeding, migratory stop-over, and feeding areas (Audubon Vermont , 2015). Many migratory routes are passed from one generation to the next. Impacts can vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, and impacts are expected to be less than significant. 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 effects to migratory pathways.

[159] A location chosen by an animal for hibernation.

<u>Reptiles and Amphibians</u>

Several species of mole salamanders and the wood frog are known to migrate seasonally in Vermont. 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, a small percentage of juvenile wood frogs can migrate over 1.5 miles from natal ponds (Berven & Grudzien, 1990), suggesting juveniles may be capable of migrating relatively long distances. Mortality and barriers to movement could occur as result of the Proposed Action (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but and impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

<u>Terrestrial Invertebrates</u>

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of Vermont'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.

<u>Terrestrial Mammals</u>

Restricted access to important winter hibernacula or summer maternity roosts for bats and calving grounds for large mammals, such as moose, has the potential to negatively affect body condition and reproductive success of mammals in Vermont. For example, moose use certain types of habitats that allow for more effective defense of their calves from predators.

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.

<u>Birds</u>

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 under the MBTA and BGEPA.

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 oould 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 Vermont's wildlife are described below.

Terrestrial Mammals

In Vermont, white-tailed deer are the most common nuisance mammals. They destroy native vegetation resulting in erosion and water resource concerns, and can carry/transmit disease to livestock and human beings. This, in turn, can seriously reduce native populations of animals and lead to the degradation of their habitat, including bear (*Ursus americanus*), turkey (*Meleagris gallopavo*), and waterfowl.

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations. Invasive species effects to terrestrial mammals could be minimized following BMPs in Chapter 17 to reduce the introduction potential from heavy equipment or laborers.

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 Vermont, 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 (USFWS, 2007a). 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 Vermont; although non-native reptiles and amphibians are known to occur there. Non-native reptiles and amphibians tend to be highly adaptable and can threaten native wildlife by competing with them for food sources and also spread disease. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would be limited. Invasive terrestrial reptile or amphibian species are not expected to be introduced at project sites from machinery or laborers.

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects pose a large threat to forest and agricultural resources (USFS, 2015e). 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 Vermont and are known to cause irreversible damage to native forests. The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs and mitigation measures would help to avoid or minimize the potential for introducing invasive plant species during implementation of the Proposed Action. Invasive species effects related to terrestrial invertebrates could be minimized with the implementation of BMPs and mitigation measures.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts

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

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant*: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable*: Lighting up of dark fiber would have no impacts to wildlife resources.
- 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 to 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 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 (see Section 3.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/mortality could occur.
  - *Installation of Optical Transmission or Centralized Transmission Equipment*: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation;

effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - *New Wireless Communication Towers*: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to wildlife. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - *Deployable Technologies*: Implementation of deployable technologies including COWs, COLTs, and SOWs could result in direct injury/mortalities to wildlife on roadways. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. RF hazards could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

    Deployment of drones, balloons, blimps, and piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be less than significant given the small-scale of likely individual FirstNet projects; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts. The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to wildlife resources associated with routine inspections of the Preferred Alternative. Site maintenance would be infrequent, including mowing or limited application of herbicides, may result in less than significant effects to wildlife including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms.

Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and therefore would likely than less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no 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 3.1.6.4, Terrestrial Wildlife.

14.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Vermont 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, 2012c).

Based on the impact significance criteria presented in Table 14.2.6-1, 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 measure.

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 14.2.4, Water Resources) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. For example, restrictions or alterations to waterways could alter migration patterns, limit fish passage, or affect foraging and spawning site access. Impacts are expected to be less than significant, and are anticipated to be localized and at a small-scale, and would vary depending on the species, time of year, and duration of deployment. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which can affect the overall population of individuals. Restrictions to spawning/breeding areas for fish and aquatic invertebrates and the alteration of water quality through sediment infiltration, obstruction of natural water flow, or loss of submerged vegetation resulting from the deployment of various types of infrastructure, are expected to be less than significant, though BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive plants within construction zones can occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. FirstNet deployment activities could result in short-term or temporary changes to specific project sites and these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers, therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant and animal species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
    - *Use of Existing Conduit – New Buried Fiber Optic Plant*: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
    - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable*: Lighting up of dark fiber would have no impacts to fisheries and aquatic habitats because there would be no ground disturbance.
- Satellites and Other Technologies
    - *Satellite-Enabled Devices and Equipment*: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance.
    - *Deployment of Satellites*: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have no impact on the aquatic environment.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
    - *New Build – Buried Fiber Optic Plant*: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources that support

fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects if BMPs and mitigation measures are not implemented.

- *New Build – Aerial Fiber Optic Plant*: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- *Collocation on Existing Aerial Fiber Optic Plant*: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- *New Build – Submarine Fiber Optic Plant*: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g., mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects
- *Installation of Optical Transmission or Centralized Transmission Equipment*: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
    - *New Wireless Communication Towers*: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.
    - *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to fisheries and aquatic habitats.

However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- *Deployable Technologies*: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

  Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be less than significant due to the small-scale of deployment activities and the limited number of aquatic species expected to be impacted. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The fisheries and aquatic habitat 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 no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to fisheries and aquatic habitats as a result of implementation of this alternative could be as described below.

<u>Deployment Impacts</u>

As explained above, implementation of deployable technologies could result in less than significant impacts from habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant. 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 3.1.6.5, Fisheries and Aquatic Habitats.

14.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Vermont 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 14.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes across the state, the potential impacts to threatened and endangered species addressed below are presented as a range of possible impacts.

Table 14.2.6-2: 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.	

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect	No Effect
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat.
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 14.2.6-2, 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 Vermont are described below

Terrestrial Mammals

The federally listed Indiana bat (*Myotis sodalis*) and the Northern Long-eared bat (*Myotis septentrionalis)* are both believed to or are known to occur in Vermont. Direct mortality or injury to the Indiana bat or the Northern Long-eared bat could occur if tree clearing activities occurred during the roosting season (i.e., approximately April-November) if bats were present. Human disturbance in and around hibernacula when bats are present could lead to adverse effects to these species as well. 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

There are no federally listed birds in Vermont.

Fish

There are no federally listed fish in Vermont.

Reptiles and Amphibians

There are no federally listed amphibians or reptiles in Vermont.

Invertebrates

One federally listed mussel, the dwarf wedgemussel (*Alasmidonta heterodon*), occurs in Vermont. Direct mortality or injury could occur to these species if deployment activities associated with the Proposed Action occur in an area inhabited by this species. Distribution of these species is limited to the Connecticut River along the eastern border with New Hampshire. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Plants

Direct mortality to federally listed plants could occur if land clearing or excavation activities associated with the Proposed Action occur in wetlands or along shorelines of the Connecticut River within southeastern Vermont in an area inhabited by Jesup's milk-vetch (*Astragalus robbinsii var. jesupi)* and the northeastern bulrush *(Scirpus ancistrochaetus)*. In general, distribution of these species is very limited throughout the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

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, amphibians, fish, invertebrates, and plants with known occurrence in Vermont are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect the Indiana bat or the Northern Long-eared bat within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. Construction activities in the immediate area around a roost tree could startle federally listed bats causing them to abandon their roost tree. For example, in Missouri after a bulldozer was used to clear brush under the tree, Indiana bats (*Myotis sodalis*) were found to abandon their primary roost site (USFWS, 2007b). However, there are other examples of Indiana bats tolerating noise. During studies at the Fort Drum Connector highway project in New York, found a maternity colony along the Interstate unaffected by vehicles traveling back and forth (USFWS, 2009b). 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

There are no federally listed birds in Vermont.

Reptiles and Amphibians

There are no federally listed reptiles or amphibians in Vermont.

Fish

There are no federally listed fish in Vermont.

Invertebrates

Changes in water quality from ground disturbing activities could cause stress resulting in lower productivity for federally listed invertebrates known to occur in Vermont. In addition, introduction of invasive aquatic species could indirectly affect the dwarf wedgemussel (*Alasmidonta heterodon*) if fish species that they rely on for their reproductive cycle were affected by the invasive species (USFWS, 2015j). Impacts associated with deployment activities are expected to result in less than significant changes to water quality. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Plants

No reproductive effects to federally listed plants are expected as a result of the Proposed Action as limited pesticides would be used and avoidance measures could be undertaken.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered potentially significant. Potential effects to federally listed terrestrial mammals, the one invertebrate, and plants with known occurrence in Vermont are described below.

Mammals

Noise 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

There are no federally listed birds in Vermont.

Reptiles and Amphibians

There are no federally listed reptiles or amphibians in Vermont.

Fish

There are no federally listed fish in Vermont.

Invertebrates

Changes in water quality, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed invertebrates resulting in lower productivity. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary for geographic 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.

Terrestrial Mammals

No critical habitat has been designated for terrestrial mammals in Vermont. 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. BMPs and mitigation measures to help mitigate or reduce these impacts are described further below.

Birds

There are no federally listed birds in Vermont and therefore no critical habitat for birds is present in Vermont.

Reptiles and Amphibians

There are no federally listed reptiles or amphibians in Vermont and therefore no critical habitat for reptiles or amphibians is present in Vermont.

Fish

There are no federally listed fish in Vermont therefore no critical habitat is present for fish in the state.

Invertebrates

No designated critical habitat occurs for terrestrial or aquatic invertebrates in Vermont. 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 Vermont. 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[160], 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

[160] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

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 to 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., bats, mollusks).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 right-of-ways (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 3.2.4, *Water Resources*, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical time periods, reproductive effects and behavioral changes could occur.

- *Installation of Optical Transmission or Centralized Transmission Equipment*: If installation of transmission equipment would occur in existing boxes or huts, there would be no impacts to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.

- Wireless Projects
  - *New Wireless Communication Towers*: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are required, impacts could be similar to new wireless construction. Hazards related security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - *Deployable Technologies*: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

Deployment of drones, balloons, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. These impacts may affect, but are not likely adversely affect protected species; Chapter 17 identifies BMPs and mitigation measures that FirstNet and/or its partners may implement, as practicable and feasible, and as defined through consultation with the appropriate resource agency, that could help to mitigate or reduce potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The threatened and endangered species that would be affected would depend on the species' phenology and the nature and extent of the habitats affected.

It is anticipated that operational impacts may affect, but are not likely to adversely affect threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect threatened and endangered species, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 17, may be implemented by FirstNet and/or its partners as practicable and feasible to further minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no 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.

<u>Deployment Impacts</u>

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.

<u>Operation Impacts</u>

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 by FirstNet and/or its partners as practicable and feasible to further 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 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 14.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

14.2.7. Land Use, Recreation, and Airspace

14.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Vermont 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.

14.2.7.2. 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 14.2.7-1. As described in Section 14.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to land use, recreation, and airspace resources addressed in this section are presented as a range of possible impacts.

Table 14.2.7-1: 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

14.2.7.3. 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 14.2.7-1, 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 14.2.7-1, 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 14.2.7-1, 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 14.2.7-1, 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[161] considerations.

Based on impact significance criteria presented in Table 14.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. As drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period of time, FirstNet would not impact airspace resources.

[161] Special Use Area.

14.2.7.4. 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 and recreation, and others would not. Impacts to airspace are not anticipated as these activities would comply with all FAA regulations. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - *New Build – Buried Fiber Optic Plant*: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - <u>Land Use:</u> See Activities Likely to Have Impacts below.
    - <u>Recreation:</u> See Activities Likely to Have Impacts below.
    - <u>Airspace:</u> 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 14.1.7.5, 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.
    - <u>Land Use:</u> 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.
    - <u>Recreation:</u> See *Activities Likely to Have Impacts* below.
    - <u>Airspace:</u> 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 14.1.7.5, 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.

- *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 14.1.7.5, 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 14.1.7.5, 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 Above Ground Level (AGL) or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 14.1.7.5, Obstructions to Airspace Considerations. The section below addresses potential impacts from balloons and drones.
- Satellites and Other Technologies
  - *Satellite-Enabled Devices and Equipment*: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.

    - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed but would not restrict access to, or enjoyment of, recreational lands.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact airspace because those activities would not result in changes to flight patterns and airspace usage or result in obstructions to airspace.

  - *Deployment of Satellites*: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact to land use, it is anticipated that this activity would have no impact to land use.

Activities with the Potential to Have Impacts

Potential construction/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 or 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 14.1.7.5, 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 Vermont'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 Vermont airports (See obstruction criteria in Section 14.1.7.5, 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, including the construction of access roads. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Additionally FirstNet (or its network partners), would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 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 14.2.8, 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.

14.2.7.5. 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 no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to land use, recreation, and airspace resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use if deployment occurs in areas with compatible land use. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected, however, impacts would be less than significant due to the temporary nature of likely deployment activities. If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, FirstNet (or its partners) would consult with the FAA to determine how to proceed. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall, these potential impacts would be less than significant due to the temporary nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 14.1.7, Land Use, Recreation, and Airspace.

14.2.8. Visual Resources

14.2.8.1. Introduction

This section describes potential impacts to visual resources in Vermont 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.

14.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 14.2.8-1. 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.

Table 14.2.8-1: 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

14.2.8.3. 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 Vermont, residents and visitors travel to many national and state parks and forests, such as Green Mountain National Forest, to view its dense forests, mountains, and wildlife. 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. Vermont's Land Use and Development Law, known as Act 250, requires that proposed development projects comply with 10 criteria intended to minimize environmental impact, including aesthetics. In Vermont, large development activities require a permit application for review by one of the nine District Environmental Commissions established by the Agency of Natural Resources' Natural Resources Board. The appropriate Commission reviews the application to ensure the project complies with the requirements of Act 250 (Vermont Natural Resources Board, 2015). If new towers were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Based on the impact significance criteria presented in Table 14.2.8-1, 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 14.2.8-1, 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.

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - *Collocation on Existing Aerial Fiber Optic Plant*: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited.
  - *Use of Existing Conduit – New Buried Fiber Optic Plant*: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable*: Lighting up of dark fiber would have no impacts to visual resources because there would be no ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.
- Satellites and Other Technologies
  - *Satellite-Enabled Devices and Equipment*: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.
  - *Deployment of Satellites*: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact to visual resources.

Activities with the Potential to Have Impacts

Potential construction/deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant*: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to visual resources. The degree of impact would depend on the timing, location, and type of project; installation of a hut or POP would be permanent, whereas ground disturbing activities would be short-term. In most cases, development located next to existing roadways would not affect visual resources unless vegetation were removed or excavation occurred in scenic areas.
  - *New Build – Aerial Fiber Optic Plant*: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public rights-of-ways would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
  - *New Build – Submarine Fiber Optic Plant*: The installation of cables in limited nearshore and inland bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable.
  - *Installation of Optical Transmission or Centralized Transmission Equipment*: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
  - *New Wireless Communication Towers*: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if

new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.

- *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if structural hardening or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
- *Deployable Technologies*: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lightning.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. 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 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.

14.2.8.5. 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 no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be less than significant as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. The potential visual impacts—including aesthetic conditions and nighttime lighting—of the operation of deployable technologies would be less than significant. These potential impacts would be similar to the potential impacts described for the Deployable Technologies option of the Preferred Alternative, above, only likely with greater numbers of deployable units.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to visual resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 14.1.8, Visual Resources.

14.2.9. Socioeconomics

14.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Vermont 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.

14.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 14.2.9-1. 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.

14.2.9.3. Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts related to Changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would likely result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Table 14.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation 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 Mitigation 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

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values below typical market values due to below average public safety communication services. Improved services would likely reduce response times and improve responses. These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Existing Environment, property values vary considerably across Vermont. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $256,000 in the Burlington area, to approximately $145,000 in the St. Johnsbury area. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts related to Changes in 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 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 benefits 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 Vermont. The average unemployment rate in 2014 was 4.1 percent, considerably lower than the national rate of 6.2 percent. Most counties in Vermont had unemployment rates below the national average (that is, better employment performance), with the exception of two counties in the northeast 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 14.2.9-1 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.

14.2.9.4. 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 14.2.9-1.

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; and
- Changes in Population Number or Composition.

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas.

Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant*: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
    - <u>Changes to Spending, Income, Industries, and Public Revenues</u> – 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.
    - <u>Impacts to Employment</u> – 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:
    - <u>Changes to Spending, Income, Industries, and Public Revenues</u> – 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.
    - <u>Impacts to Employment</u> – 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:
    - <u>Changes to Spending, Income, Industries, and Public Revenues</u> – 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.
    - <u>Impacts to Employment</u> – 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:

- <u>Changes to Spending, Income, Industries, and Public Revenues</u> – 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.
- <u>Impacts to Employment</u> – 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 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.

14.2.9.5. 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 no 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 14.1.9, Socioeconomics.

14.2.10. Environmental Justice

14.2.10.1. Introduction

This section describes potential impacts to environmental justice in Vermont 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.

14.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 14.2.10-1. 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.

14.2.10.3. 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." (Council on Environmental Quality, 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.

Table 14.2.10-1: 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

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 (Council on Environmental Quality, 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 (Council on Environmental Quality, 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 4.2.9).

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 Existing Environment (Section 14.1.10) as having moderate potential or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 14.1.10, Vermont’s population has very low percentages of minorities compared to the region and the nation, and a somewhat lower poverty rate than the region or nation. Vermont does have many areas with high potential for environmental justice populations. The distribution of these high potential areas and of moderate potential areas is fairly even across the state. Given Vermont’s very low rates of minority populations, it is likely that these areas mostly reflect relative prevalence of low-income populations. Further analysis using the data developed for the screening analysis in Section 14.1.10 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, 2014d).

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.

14.2.10.4. 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, 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 to environmental justice.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
    - *New Build – Buried Fiber Optic Plant*: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures. These activities could temporarily generate noise and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
    - *New Build – Aerial Fiber Optic Plant*: Pole/structure installation could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
    - *New Build – Submarine Fiber Optic Plant*: The installation of cables in limited nearshore and inland bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore to accept submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
    - *Installation of Optical Transmission or Centralized Transmission Equipment*: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
- Wireless Projects

- *New Wireless Communication Towers*: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
- *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
- *Deployable Technologies*: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than significant, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Activities to Have No Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. It is anticipated that such activities would not result in environmental justice impacts, as the intensity of these activities would be low (low potential for objectionable effects such as noise and dust) and their duration would be very short. Routine maintenance and inspection would not adversely affect property values, for the same reasons.

Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment activities that involve construction.

Impacts are expected to be less than significant. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

14.2.10.5. 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 no 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. 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 14.1.10, Environmental Justice.

14.2.11. Cultural Resources

14.2.11.1. Introduction

This section describes potential impacts to cultural resources in Vermont 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.

14.2.11.2. 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 14.2.11-1. As described in Section 14.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to cultural resources addressed in this section are presented as a range of possible impacts.

14.2.11.3. 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 14.2.11-1, 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 Vermont, some deployment activities may be in these same areas, in which case BMPs (see Chapter 17) could help avoid or minimize the potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of potentially significant impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alter historic architectural features. 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.

Table 14.2.11-1: 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.

14.2.11.4. 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, attaching equipment to satellites launched for other purposes, 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 to 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 resources. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant*: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - *New Build – Aerial Fiber Optic Plant*: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - *New Build – Submarine Fiber Optic Plant*: The installation of cables in limited nearshore and inland bodies of water could impact cultural resources, 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 historic sites, such as stone retaining walls and piers in rivers and lakes (archaeological deposits tend to be located in association with bodies of water), and the associated structures could have visual effects on historic properties.
  - *Installation of Optical Transmission or Centralized Transmission Equipment*: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - *Collocation on Existing Aerial Fiber Optic Plant*: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
  - *New Wireless Communication Towers*: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
  - *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in impacts to archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas that have larger concentrations of historic buildings.
  - *Deployable Technologies*: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment site. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties, however, due to the small-scale of expected activities, these actions could affect but would not likely adversely effect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA.

14.2.11.5. 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 no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to cultural resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse 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 14.1.11, Cultural Resources.

14.2.12. Noise

14.2.12.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and Alternatives in Vermont. 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.

14.2.12.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 14.2.12-1. As described in Section 14.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential noise impacts to Vermont addressed in this section are presented as a range of possible impacts.

14.2.12.3. 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 14.2.12-1, 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 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 14.2.12-1: 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

14.2.12.4. 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 Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise impacts and while others would not.

In addition, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios, the following are likely to have no noise impacts under the conditions described below:

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant*: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable*: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
  - *Satellite Enabled Devices and Equipment*: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
  - *Deployment of Satellites*: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact to those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant*: Plowing (including vibratory plowing), trenching, or directional boring and the construction of 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 also increase noise levels.

- *Collocation on Existing Wireless Tower, Structure, or Building*: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
- *Deployable Technologies*: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be less than significant due to the temporary duration of deployment activities. Additionally, pre-existing noise levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction) See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be less than significant and for routine maintenance and inspection of the facilities because of the temporary nature of the activities which would not create new permanent sources of noise. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be similar to or less than those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections or onsite generator use occurs, potential noise impacts could result as explained above. 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.

14.2.12.5. 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 no 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 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.

14.2.13. Air Quality

14.2.13.1. Introduction

This section describes potential impacts to Vermont's air quality from 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.

14.2.13.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Vermont's air quality were evaluated using the significance criteria presented in Table 14.2.13-1. As described in Section 14.2, 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 Vermont's air quality addressed in this section are presented as a range of possible impacts.

Table 14.2.13-1: Impact Significance Rating Criteria for Vermont

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with Mitigation 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

14.2.13.3. 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.

Based on the significance criteria presented in Table 14.2.13-1, air emission impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of emission sources be deployed/operated long-term in the same area from fixed or mobile sources or construction activities. Less than significant emissions could occur for any of the criteria pollutants within attainment areas in Vermont; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present throughout Vermont (Figure 14.1.12-1), FirstNet would try to minimize potential emissions where possible and would recommend the implementation of BMPs, where feasible and practicable, to avoid or minimize potential impacts.

14.2.13.4. 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 and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, 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 to 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 short duration and localized nature of the activities. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant*: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs , huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in fugitive dust and products of combustion from the use of vehicles and heavy equipment.
  - *New Build – Aerial Fiber Optic Plant:* The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, 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 vehicles 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 and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - *Collocation on Existing Wireless Tower, Structure, or Building:* Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If structural hardening and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
  - *Deployable Technologies*: The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts 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.

14.2.13.5. 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 no 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 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.

14.2.14. Climate Change

14.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Vermont 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.

14.2.14.2. 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 14.2.12-1. 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 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 (Council on Environmental Quality, 2014).

Table 14.2.14-1: Impact Significance Rating Criteria for Climate Change

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

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 (Council on Environmental Quality, 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, 2015n), 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 (Council on Environmental Quality, 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.

14.2.14.3. 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 (U.S. Global Change Research Program, 2014a).

Air Temperature

Figure 14.2.14-1 and Figure 14.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Vermont from a 1969 to 1971 baseline. Vermont has one sub-climate, as described below.

Dfb **– Figure 14.2.14-1** shows that by mid-century (2040 to 2059), temperatures in the entire state of Vermont under a low emissions scenario will increase by approximately 4 °F, and by the end of the century (2080 to 2099) under a low emissions scenario temperatures in the entire state of Vermont will increase by approximately 6 °F (U.S. Global Change Research Program, 2009).

Figure 14.2.14-2 shows that under a high emissions scenario for the period (2040 to 2059), temperatures will increase by approximately 5 °F. Under a high emissions scenario for the period (2080 to 2099) in the majority of the (Cfa) region of Vermont, temperatures will increase by approximately 9° F. However, in the northern and northwestern most portions of the state under a high emissions scenario at the end of the century, temperatures will increase by approximately 10 °F (U.S. Global Change Research Program, 2009).

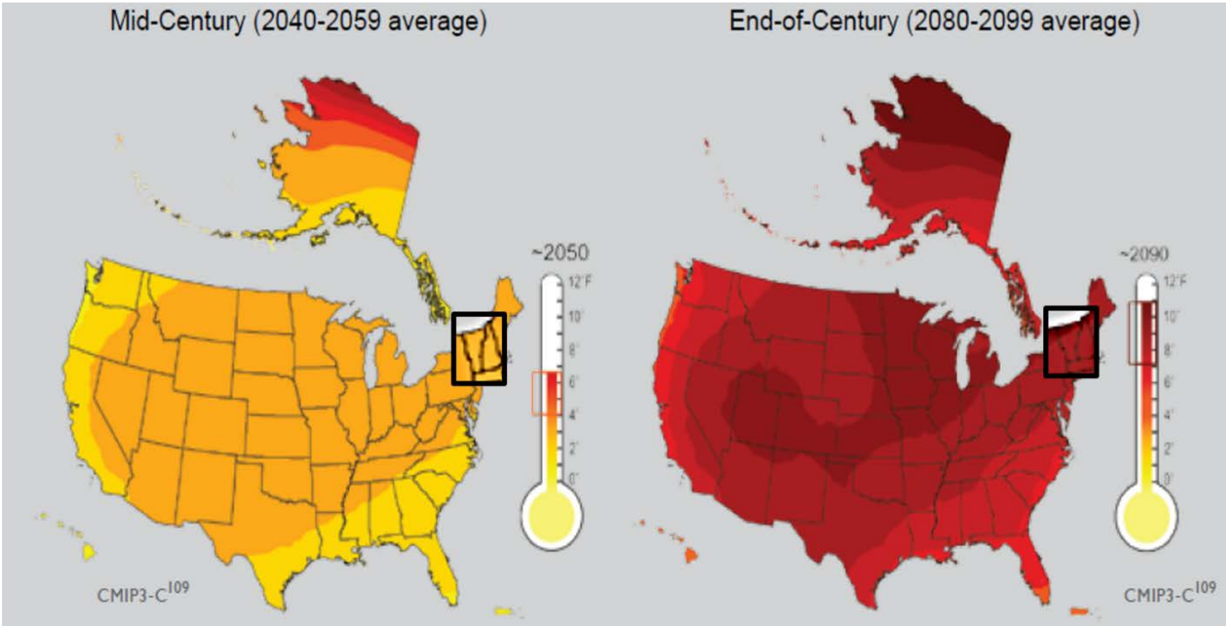

Figure 14.2.14-1: Vermont Low Emission Scenario Projected Temperature Change

Source: (U.S. Global Change Research Program, 2009)

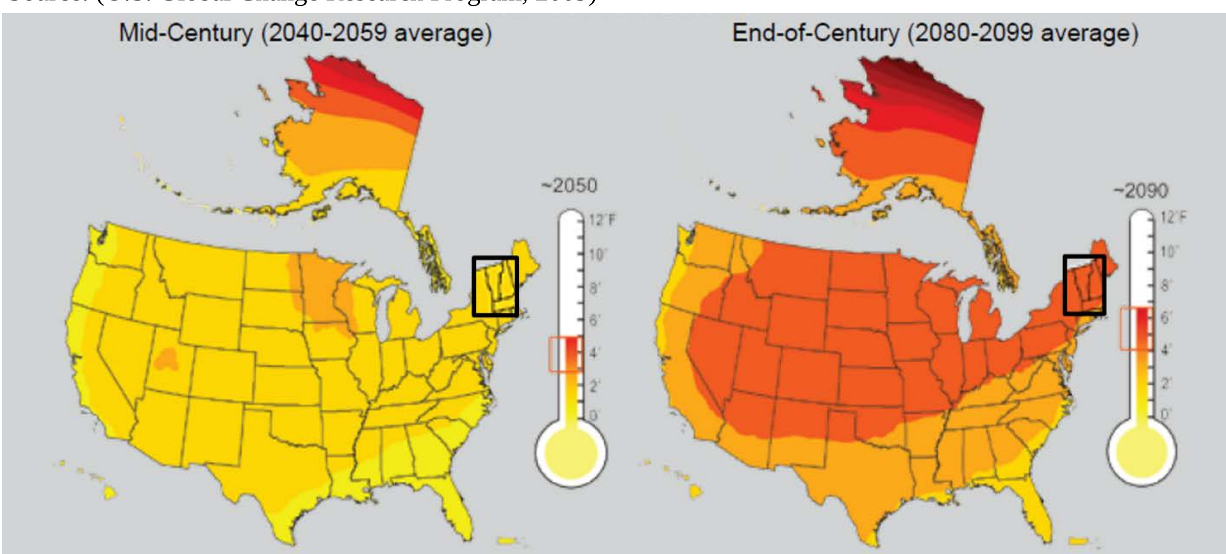

Figure 14.2.14-2: Vermont High Emission Scenario Projected Temperature Change

Source: (U.S. Global Change Research Program, 2009)

Precipitation

By late in the century under a high emissions scenario, winters in the Northeast are projected to be much shorter with fewer cold days and more precipitation. Winter and spring precipitation is projected to increase, and the frequency of heavy downpours is projected to continue to increase as the century progresses. Seasonal drought risk is also projected to increase in summer and fall as higher temperatures lead to greater evaporation and earlier winter and spring snowmelt (U.S. Global Change Research Program, 2009).

Figure 14.2.14-3 and Figure 14.2.14-4 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 3.14.5-3 show seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050 (U.S. Global Change Research Program, 2014b).

Figure 14.2.14-4 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.) (U.S. Global Change Research Program, 2014b). Vermont has one sub-climate, as described below.

Dfb **–** Figure 14.2.14-3 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 Vermont. However, there are no expected increases in precipitation in fall other than fluctuations due to natural variability (U.S. Global Change Research Program, 2014b).

Figure 14.2.14-4 shows that if emissions continue to increase, winter precipitation could increase as much as 30 percent over the period 2071 to 2099. In spring, precipitation in this scenario could increase as much as 20 percent. In summer, precipitation in the majority of the (Dfb) region will increase by 10 percent, and in the northern most portion of the region there is no expected change in precipitation. No significant change to fall precipitation is anticipated over the same period (U.S. Global Change Research Program, 2014b).

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 definitive links between severe weather events and climate change (U.S. Global Change Research Program, 2014c).

United States coastal waters are expected to experience more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of storms that make landfall) (U.S. Global Change Research Program, 2014c). Changes in hurricane intensity are difficult to project because there are contradictory effects at work. Warmer oceans increase storm strength with higher winds and increased precipitation. However, changes in wind speed and direction with height are also projected to increase in some regions; this tends to inhibit storm formation and growth. Current research suggests stronger, more rain-producing tropical storms and hurricanes are generally more likely, though such storms may form less frequently; ultimately, more research will hopefully lead to greater certainty (U.S. Energy Information Administration, 2015f).

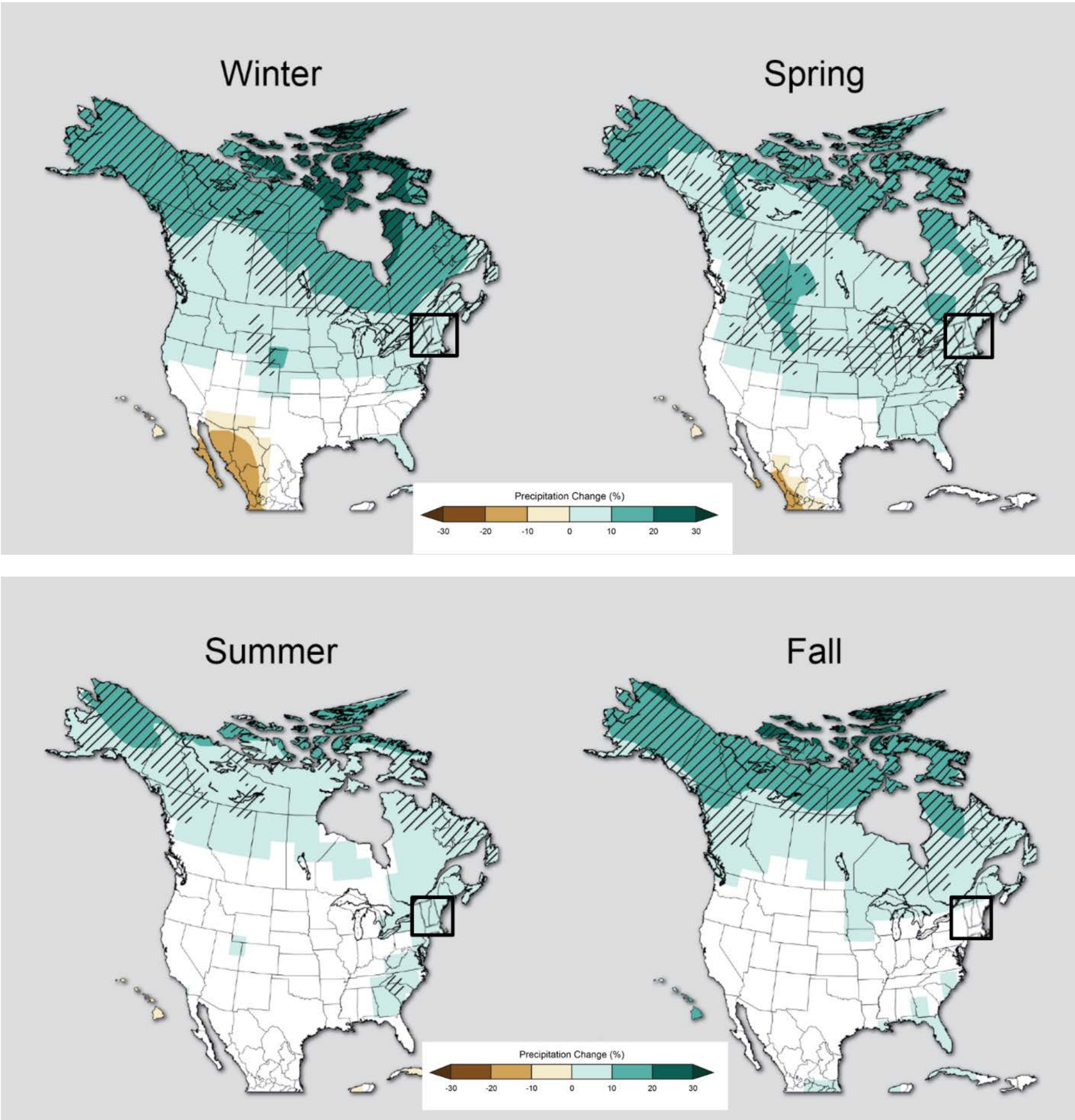

Figure 14.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (U.S. Global Change Research Program, 2014b)

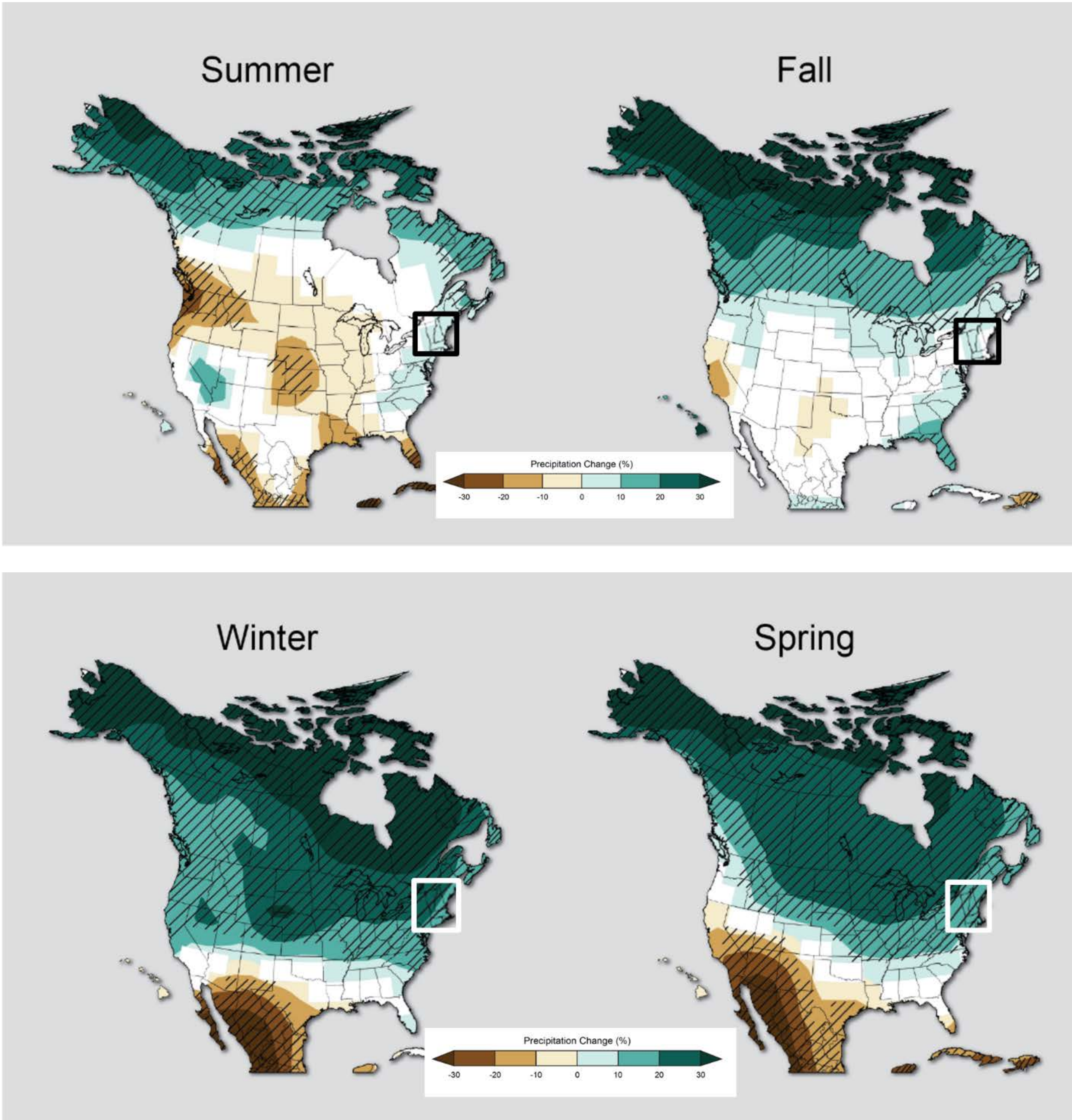

Figure 14.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (U.S. Global Change Research Program, 2014b)

14.2.14.4. 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 14.2.14-1, 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 (U.S. Energy Information Administration, 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 is less carbon-intensive, and would generate approximately 240 MT of CO_2 per year for the same equipment, depending on the region of the United States where the electricity was generated (USEPA, 2014e). Furthermore, the components of the system would not necessarily all be this large, running all the time, or at full power. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison, optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Willem Vereecken, 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Project-Related Resource Effects

Climate change may impact project-related effects by magnifying or otherwise altering impacts in other resources areas. For example, climate change may impact air quality, water resource availability, and recreation. These effects would vary from state to state depending on the resources in question and their relationship to climate change. These impacts will be considered fully in Chapter 18, Cumulative Impacts. No BMPs will be described for this aspect of the resource.

More frequent and severe torrential downpours are anticipated in the Northeast United States, and will have negative consequences for both natural and built environments in Vermont (U.S. Global Change Research Program, 2014d). 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, particularly in areas where storm sewer systems and sanitary sewer systems are still connected (State of Vermont, 2011a).

Warming temperatures are also anticipated to negatively affect skiing and other tourism, as well as important agricultural sectors such as dairy, maple sugar, and cold-weather crops (State of Vermont, 2010b). Rising temperatures, heat, are expected to have a range of complex and difficult-to-predict effects including the spread of insect-borne diseases and periods of extreme heat. These effects are anticipated to have the greatest impact on persons of low socioeconomic status (State of Vermont, 2011b).

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.

With Vermont at increasing risk of flooding under warming scenarios, the growing frequency and severity of torrential downpours, with increased incidences of flash flooding particularly in areas with inadequate stormwater infrastructure (State of Vermont, 2011a) (U.S. Global Change Research Program, 2014e) may impact FirstNet Installations and Infrastructure. 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 in the Northeast region (U.S. Department of Energy, 2015) while sustained high temperatures may overwhelm the capacity onsite equipment needed to keep microwave and other transmitters cool.

14.2.14.5. 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 Vermont, 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 right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.

- *Collocation on Existing Aerial Fiber Optic Plant*: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities.
- *New Build – Submarine Fiber Optic Plant*: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small 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 potentially significant if large numbers of piloted or unmanned aircraft were used for a sustained period of time (i.e. months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be less than significant due to the limited and localized nature of deployment activities. See Chapter 17, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could be potentially significant to less than significant with BMPs and mitigation measures incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause. 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.

14.2.14.6. 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 no 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. 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.

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term.

Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. These activities are expected to be less than significant due the limited duration of deployment activities.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. 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. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. Climate change effects have the most noticeable impacts over a long period. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above. 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 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 14.1.14, Climate Change.

14.2.15. Human Health and Safety

14.2.15.1. Introduction

This section describes potential impacts to human health and safety in Vermont 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.

14.2.15.2. 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 14.2.15-1. As described in Section 14.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to human health and safety addressed in this section are presented as a range of possible impacts.

14.2.15.3. 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 14.2.15-1, 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.

Table 14.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Incorporated**	**Less than Significant**	**No Impact**
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And Manmade Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event	NA

NA = not applicable

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

- Engineering controls,
- Work practice controls,
- Administrative controls, and
- 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 (U.S. Department of Commerce, 2013a). 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, SOPs 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 (U.S. Department of Commerce, 2013a). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks, and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE is the common term used to refer to the equipment worn by employees to minimize exposure to chemical and physical hazards. Examples of PPE include gloves, protective footwear, eye protection, protective hearing devices (earplugs, muffs), hard hats, fall protection, respirators, and full body suits. PPE is the last line of defense to prevent occupational injuries and exposure.

The Vermont Occupational Safety and Health Administration (VOSHA) within the Vermont Department of Labor, Workers' Compensation, and Safety Division is authorized by U.S. 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. VOSHA is also authorized by U.S. OSHA to administer the state's private sector program for occupational safety. However, VOSHA does not oversee federal employers. Therefore, with the exception of federal employers, VOSHA is responsible for all regulatory authority and enforcement for occupational safety relating to FirstNet site work.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination and mine lands at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed as a result of site activities. Mines may cause unstable surface and subsurface conditions as a result of underground shaft collapses or seismic shifting. Based on the impact significance criteria presented in Table 14.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties or abandoned or active mine lands. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination and/or mining activities using federal resources such as the USEPA Cleanups in My Community database and U.S. Department of Interior's Abandoned Mine Lands inventory, through the VTDEC, or through an equivalent commercial resource, such as Environmental Data Resources, Incorporated.

By screening sites for environmental contamination, mining activities, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination or mining activities, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination (or mine lands) are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards.

Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, CERCLA, and applicable Vermont 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 VTDEC 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 14.2.15-1, 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 likely develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

14.2.15.4. 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 to those resources.

Activities with the Potential to Have Impacts

Potential construction/deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant*: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
  - *New Build – Aerial Fiber Optic Plant*: Installation of new poles and fiber optic lines could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed

deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- *Collocation on Existing Aerial Fiber Optic Plant*: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- *New Build – Submarine Fiber Optic Plant*: The installation of fiber optic cables in limited nearshore and inland bodies of water requires workers to operate over aquatic environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shore to accept submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- *Installation of Optical Transmission or Centralized Transmission Equipment*: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
    - *New Wireless Communication Towers*: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects.

Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

  - *Collocation on Existing Wireless Tower, Structure, or Building*: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
  - *Satellite-Enabled Devices and Equipment*: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent

equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, and environmental contamination), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure and release of hazardous chemicals and hazardous waste. 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.

14.2.15.5. 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 no 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, 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 14.1.15, Human Health and Safety.

VT APPENDIX A – WATER RESOURCES

Table A-1. Characteristics of Vermont's Watersheds, as Defined by DEC

Watershed/Size Land Area within VT (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
Batten Kill, Walloomsac, Hoosic (428)	Batten Kill Walloomsac River Hoosic River	• Flood and erosion hazard risks
Southern Lake Champlain (498)	Poultney River Mettowee River Southern Lake Champlain direct drainages Lake Champlain	• E. coli/pathogens • Flood and erosion hazard risks • Sediment runoff from agriculture and gravel roads • Sediment runoff as source of phosphorus pollution to Lake Champlain
Otter Creek, Little Otter Creek, Lewis Creek (936)	Otter Creek Little Otter Creek Lewis Creek	• E. Coli/pathogens • Agricultural runoff • Phosphorus loading • Flood and erosion hazard risks
Northern Lake Champlain (653)	Northern Lake Champlain direct drainages Lake Champlain	• Algal blooms • High levels of pathogens or turbidity in the water • High levels of mercury and PCBs • Aquatic invasive species • Phosphorus loading into Lake Champlain
Missisquoi (1,200)	Missisquoi River Black Creek Tyler Branch and Trout River Rock and Pike Rivers	• High levels of mercury • Pathogens • Nutrients
Lamoille (706)	Lamoille River Wild Branch North Branch Brewster River Browns River Lake Champlain Caspian Lake Lake Elmore Green River Reservoir Arrowhead Mountain Lake	• Stream instability and flooding • Stormwater runoff • Agricultural runoff • Transportation infrastructure problems (bridges, culverts, rail and road embankments, & driveway accesses) • Water level fluctuations, stream instability, and fish passage concerns from dams
Winooski (1,080)	Winooski River Little River, Kingsbury Branch, North Branch, Stevens Branch, Dog River, Mad River, and Huntington River Lake Champlain	• High levels of mercury • Sedimentation • Agricultural and Urban runoff • Pathogens • Nutrient loading, including phosphorus
Passumpsic (507)	Passumpsic River	• Pathogens • Flood and erosion hazard risks • Nutrients, including nitrogen and phosphorus
Upper Connecticut (989)	Connecticut River Direct drainages to the Connecticut River Nulhegan River Paul Stream	• Pathogens • Flood and erosion hazard risks • Nutrients, including nitrogen and phosphorus

Watershed/Size Land Area within VT (square miles)	Major Surface Waterbodies	Major Water Quality Concerns
White (710)	White River	• E. coli/pathogens • Nutrients, including nitrogen and phosphorus • Non-point source pollution from gravel roads
Stevens, Waits, Wells, and Ompompanoosuc (579)	Ompompanoosuc River Stevens River Waits River Wells River Direct drainages to the Connecticut River	• Nutrients, including nitrogen and phosphorus • Non-point source pollution from gravel roads • Agricultural runoff
Ottauquechee and Black (425)	Ottauquechee River Black River	• Sedimentation • Flow alteration • Pathogens • Nutrients, including nitrogen and phosphorus
West, Williams and Saxtons (696)	West River Williams River Saxtons River Direct drainages to the Connecticut River	• Sedimentation • Acidity • Pathogens • Nutrients, including nitrogen and phosphorus
Deerfield (400)	Deerfield River Direct drainages to the Connecticut River	• Flood and erosion hazard risks • E. coli/pathogens • Invasive species • Agricultural runoff
Lake Memphremagog (589)	Lake Memphremagog Tomifobia River Coaticook River	• Nutrient Enrichment • Algal Blooms • Invasive species • Reduced aquatic habitat

Source: (DEC, 2014c), (DEC, 2012b), (DEC, 2014d), (DEC, 2012c), (DEC, 2015aa), (DEC, 2004), (DEC, 2012d), (DEC, 2012e), (DEC, 2014e), (DEC, 2013), (DEC, 2012f), (DEC, 2015bb), (DEC, 2014f), (DEC, 2012g)

VT APPENDIX B – COMMUNITIES OF CONCERN

Table B-1: NNHP S1 Ranked Natural Community Types in Vermont

Vegetative Community Type	USEPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
Subalpine Krummholz	Northeastern Highlands	Green Mountains, Southern Vermont	Low, dense thickets of balsam fir and black spruce at high elevations. Vegetation often bent and twisted due to wind and snow/ice loading. Slow growth rate, woody plants from few inches to few feet tall.	Found only on the highest peaks in the Green Mountains.
Cold-Air Talus Woodland	Northeastern Highlands	Green Mountains	Occurs on steep slopes or in deep valleys where cold air drains at bases of large talus areas. Limited soil results in low and slow growing trees with sparse shrub and herb layers. Black spruce, abundant mosses, liverworts, and lichens.	Known from few locations in central and northeastern portions of the state.
Pitch Pine-Oak-Heath Rocky Summit	Northeastern Highlands	Champlain Valley, Southern Vermont	Fire-adapted woodland on dry, acidic ridgetops. Trees are scattered and low growing, pitch pine dominant with red and white pine, red maple and oak also common.	Known only from four areas in the state.
Pine-Oak-Heath Sandplain Forest	Eastern Great Lakes Lowlands, Northeastern Highlands	Lake Champlain, Southern Vermont	Occurs on dry sandy soils in warmer areas. Open canopies of pitch pine, red maple and black oak. Shrub understory of heath species, ground layer very sparse. Have a disproportionately high number of rare species, many of which are at their range limits in the state.	One of Vermont's rarest and most threatened communities. Sandy river deltas in Champlain Valley and Connecticut Valley.

Vegetative Community Type	USEPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
Sand Dune	Eastern Great Lakes Lowlands	Champlain Valley	Sparse overall vegetation cover, woody plants limited, with mixed perennial[162] and annual herbs. Sand dunes are always associated with sand beaches and are found landward of them.	Small patches, northwest corner of the state.
Alpine Meadow	Northeastern Highlands	Green Mountains	Open areas on the highest peaks, generally above 3,500 feet elevation. Vegetation strongly influenced by cold climate and wind-driven ice loading.	Limited to three locations on Green Mountain summits.
Serpentine Outcrop	Northeastern Highlands	Green Mountains	Areas of exposed serpentine bedrock. Being an outcrop, soils are limited and support limited numbers of shrubs and trees; grasses and herbs are more common.	Small patches in the Green Mountains, east of the main ridge.
Red Maple-White Pine-Huckleberry Swamp	Eastern Great Lakes Lowlands	Champlain Valley	Occur in forested centers of large wetland complexes. Unique in its relatively flat surface – hummocks may occur but rarely exceeding ten inches in height. Red maple and white pine co-dominant in a tall, closed canopy. Dense, low huckleberry forms a nearly complete cover over sphagnum moss.	Only known from four locations in the Champlain Valley, within large wetland complexes.
Pitch Pine Woodland Bog	Eastern Great Lakes Lowlands	Champlain Valley	Open canopy of pitch pine, with low shrubs	Only one known example, Maquam Bog, near the mouth of the Missisquoi River.

[162] Perennial plants: “Plants that live for more than two growing seasons. Perennial plants either die back after each season (herbaceous plants) or grow continuously (shrubs).” (*EPA 2015i*)

Vegetative Community Type	USEPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
			dominant. Sedges[163] abundant in areas and moss carpeting hummocks and hollows. Past fire and flooding regime may have been primary habitat influences.	
Alpine Peatland	Northeastern Highlands	Green Mountains	Occur on shallow bedrock depressions and on gentle mountain slopes in areas that capture or retain moisture from the extensive precipitation and fog experienced in these areas. Vegetation is dominated by low-growing heath shrubs that form a nearly continuous cover.	Known only from the highest peaks of Green Mountains, primarily Mount Mansfield.
Outwash[164] Plain Pondshore	Northeastern Highlands	Southern Vermont	Sloping, seasonally exposed shorelines of ponds that experience substantial and irregular annual fluctuation of water level. Known example is located in an area of glacial outwash plains. Vegetation is dominated by annual herbaceous plants.	Found only in southeastern Vermont
Calcareous[165] Riverside Seep	Northeastern Highlands, Eastern Great Lakes Lowlands	Champlain Valley, Green Mountains, Southern Vermont	Occurs on exposed bedrock along rivers and streams where calcareous groundwater seeps out. Vegetation is kept open due to flooding and ice scouring.	Known only from scattered locations along the Winooski, Passumpsic, White, and Connecticut Rivers.

Sources: (Thompson & Sorenson 2005; VFWD 2010, 2012)

[163] Sedge: "Plants of the family Cyperacae that resemble grasses, but have solid stems." (*USFWS 2015b*)
[164] Outwash: "Glacial outwash is the deposit of sand, silt, and gravel formed below a glacier by meltwater streams and rivers. An outwash plain is an extensive, relatively flat area of such deposits." (*EPA 2015j*)
[165] Calcareous: "Of or containing calcium carbonate, calcium, or limestone." (*EPA 2015k*)

ACRONYMS

Acronym	Definition
AARC	Average Annual Rate of Change
ACHP	Advisory Council On Historic Preservation
ACS	American Community Survey
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AIRFA	American Indian Religious Freedom Act
AML	Abandoned Mine Lands
ANR	Agency of Natural Resources
AQCR	Air Quality Control Region
ARPA	Act of 1979
ASL	Above Sea Level
ATC	Air Traffic Control
ATO	Air Traffic Organization
ATSDR	Agency For Toxic Substances and Disease Registry
BGEPA	Bald and Golden Eagle Protection Act
BLS	Bureau of Labor Statistics
BTOP	Broadband Technology Opportunity Program
BTV	Burlington International Airport
CAA	Clean Air Act
CDC	U.S. Center for Disease Control and Prevention
CEQ	Council On Environmental Quality
CGP	Construction General Permit
CH4	Methane
CIMC	Cleanups In My Community
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CPG	Certificates of Public Good
CRS	Community Rating System
CWA	Clean Water Act
DEC	Department of Environmental Conservation
DEMHS	Division of Emergency Management and Homeland Security
DFW	Department of Fish and Wildlife
DII	Department of Innovation and Information
DMV	Department of Motor Vehicles
DOE	Department of Energy’s
DPS	Department of Public Safety
DRPT	Department of Rail and Public Transportation
EFH	Essential Fish Habitat

Acronym	Definition
EIA	Energy Information Administration
EMS	Emergency Medical Services
EPCRA	Emergency Planning and Community Right To Know Act
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FLM	Federal Land Manager
FPR	Forests, Parks and Recreation
FSS	Flight Service Station
GCCC	Governor's Commission On Climate Change
GHG	Greenhouse Gas
GNIS	Geographic Names Information System
HAAS	Hazardous Ambient Air Standards
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
IWIN	Integrated Wireless Network
LBS	Locations-Based Services
LMR	Land Mobile Radio
LRR	Land Resource Region
LTE	Long-Term Evolution
MBTA	Migratory Bird Treaty Act
MHI	Median Household Income
MLRA	Major Land Resource Areas
MMT	Million Metric Tons
MSL	Mean Sea Level
MYA	Million Years Ago
N2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NCR	National Capital Region
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NH	New Hampshire
NHA	National Heritage Area

Acronym	Definition
NM	Nautical Miles
NNHP	Nongame and Natural Heritage Program
NOTAM	Notices To Airmen
NOX	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	Nationwide Public Safety Broadband Network
NRB	Natural Resources Board
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NTFI	National Task Force On Interoperability
NTIA	National Telecommunications and Information Authority
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OTR	Ozone Transport Region
PGA	Peak Ground Acceleration
PPE	Personal Protective Equipment
PSB	Public Service Board
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SDS	Safety Data Sheets
SF6	Sulfur Hexafluoride
SGCN	Species of Greatest Conservation Need
SHPO	Vermont Division For Historic Preservation
SIP	State Implementation Plan
SMS	Sites Management Section
SO2	Sulfur dioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedure
SOX	Oxides of Sulfur
SPL	Sound Pressure Level

Acronym	Definition
SUA	Special Use Airspace
SWPPP	Stormwater Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
TWA	Time Weighted Average
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UHF	Ultra High Frequency
UIC	Underground Injection Control
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VCOMM	Vermont Instituted the Vermont Communications Board
VDTM	Vermont Department of Tourism and Marketing
VFR	Visual Flight Rules
VFWD	Vermont Fish and Wildlife Department
VHF	Very High Frequency
VOC	Ozone
VOSHA	Vermont Occupational Safety and Health Administration
VT	Vermont
VT/NH	Brattleboro
VTA	Vermont Telecommunications Authority
WI/PWL	Waterbody Inventory/Priority Waterbodies List
WWII	World War II

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