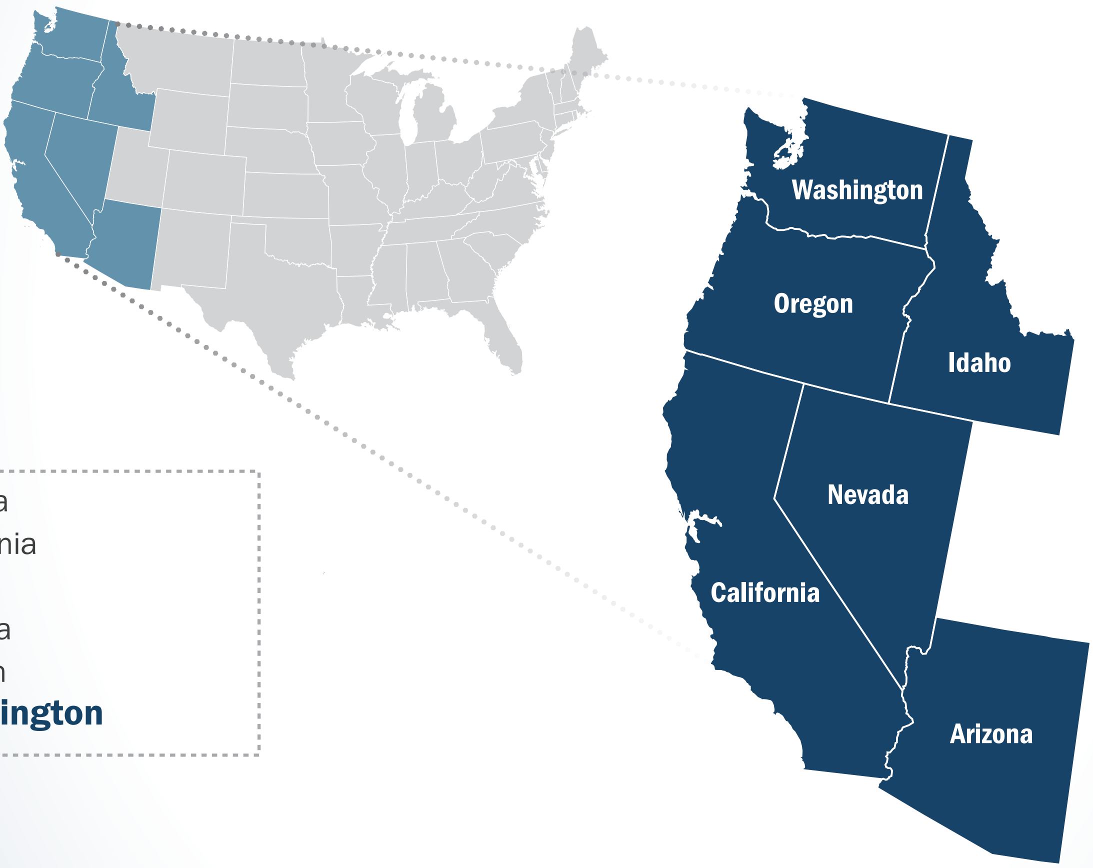
Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Western United States

VOLUME 6 - CHAPTER 8



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First Responder Network Authority

FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Western United States

VOLUME 6 - CHAPTER 8

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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

September 2016

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8. WASHINGTON

American Indian Tribes with a rich cultural history lived in what is now the state of Washington for centuries before the 1700s. Spain and Britain disputed over ownership of the Pacific Northwest, including Washington, during the 1780s; in 1790, both nations signed a treaty giving the land to Britain. For some time after the Revolutionary War, both British and American citizens were allowed to settle in Washington. In 1846, a treaty officially ceded the land to the United States. Washington was finally granted statehood in 1889 (Washington Secretary of State, 2015a). Washington is bordered by Canada to the north, the Pacific Ocean to the west, Oregon to the south, and Idaho to the east. This chapter provides details about the existing environment of Washington as it relates to the Proposed Action.

General facts about Washington are provided below:

- **State Nickname:** The Evergreen State
- **Land Area**: 66,455.52 square miles; **U.S. Rank:** 18 (U.S. Census Bureau, 2015a)
- **Capital:** Olympia
- **Counties:** 39 (U.S. Census Bureau, 2015b)
- **2015 Estimated Population:** 7,170,351; **U.S. Rank:** 13: (U.S. Census Bureau, 2015a)
- **Most Populated Cites:** Bellingham, Bremerton, Everett, Kennewick, Olympia, Seattle, Spokane, Tacoma, Vancouver, Wenatchee, Yakima (U.S. Census Bureau, 2015b)
- **Main Rivers:** Columbia, Snake, Spokane, Yakima (Washington Department of Ecology, 2016a)
- **Bordering Waterbodies:** Puget Sound, Columbia River, and the Pacific Ocean (World Atlas, 2016)
- **Mountain Ranges:** Cascade Range, Olympic Mountains, and the North Cascades (World Atlas, 2016)
- **Highest Point:** Mount Rainier (14,411 feet) (USGS, 2016a).

8.1. AFFECTED ENVIRONMENT

8.1.1. Infrastructure

8.1.1.1. Introduction

This section provides information on key Washington 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 and 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 8.1.1.3 provides an overview of Washington's traffic and transportation infrastructure, including road and rail networks and waterway facilities. Washington's public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (Public Law [Pub. L.] No. 112-96, Title VI Stat. 156 (codified at 47 United States Code [U.S.C.] 1401 *et seq*.) (the Act), including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by the Act. Public safety services in Washington are presented in more detail in Section 8.1.1.4. Section 8.1.1.5 describes Washington's public safety communications infrastructure and commercial telecommunications infrastructure. An overview of Washington's utilities, such as power, water, and sewer, is presented in Section 8.1.1.6.

8.1.1.2. Specific Regulatory Considerations

Multiple Washington laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 8.1.1-1 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 8.1.1-1: Relevant Washington Infrastructure Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
RCW: Title 38 Militia and Military Affairs: WAC Title 118 Military Department (Emergency Management)	Washington State Military Department	Administers the state's emergency management program.

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

State Law/ Regulation	Regulatory Agency	Applicability
RCW: Title 80 Public Utilities: WAC: Title 480 Utilities and Transportation Commission	Washington Utilities and Transportation Commission	Regulates all gas, electrical, telecommunications, wastewater, and water companies in the state.
RCW: Title 14 Aeronautics; Title 47 Public Highways and Transportation; Title 81 Transportation : WAC Title 468 Department of Transportation	Washington Department of Transportation	Coordinates and plans for the transportation systems of the state, including highways, toll bridges, aeronautics, and canals.

8.1.1.3. Transportation

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

The Washington Department of Transportation (WSDOT) has jurisdiction over freeways and major roads, airports, railroads, mass transit, and ports in the state; local counties have jurisdiction for smaller streets and roads. The WSDOT is "responsible for ensuring that people and goods move safely and efficiently" (WSDOT 2015a).

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

- 82,448 miles of public roads (FHWA, 2014) and 8,120 bridges (FHWA, 2015a);
- Over 3,000 miles of track that includes passenger rail and freight (WSDOT, 2014);
- 544 aviation facilities, including airstrips and heliports (FAA, 2015a); and
- 75 ports that includes both public and private facilities (Washington Ports, 2016); and
- 94 harbors (U.S. Harbors, 2016).

Road Networks

As identified in Figure 8.1.1-1, the major urban centers of the state from west to east are Seattle-Tacoma, Spokane', Pullman-Moscow, and Vancouver (U.S. Census Bureau, 2013a). Washington has three major interstates connecting its major metropolitan areas to one another, as well as to other states. Travel outside major metropolitan areas is conducted on interstates and state and county roads. Table 8.1.1-2 lists the interstates and their start/end points in Washington. Per the national standard, even numbered interstates run from west to east with the lowest numbers beginning in the south; odd numbered interstates run from north to south with the lowest numbers beginning in the west (FHWA, 2015b).

Table 8.1.1-2: Washington Interstates

Interstate	Southern or western terminus in WA	Northern or eastern terminus in WA
I-5	OR line in Vancouver	Canada line in Blaine
I-82	I-90 in Ellensburg	OR line in Plymouth
I-90	Seattle Blvd. in Seattle	ID line in Liberty Lake

In addition to the Interstate System, Washington has both National Scenic Byways and State Scenic Byways. National and State Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities (FHWA 2013). Figure 8.1.1-1 illustrates the major transportation networks, including roadways, in Washington. Section 8.1.8, Visual Resources, describes the National and State Scenic Byways found in Washington from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the U.S. Department of Transportation's (DOT) Federal Highway Administration (FHWA) designates and manages byways. Washington has seven National Scenic Byways (FHWA, 2015c):

- Chinook Scenic Byway
- Coulee Corridor Scenic Byway
- International Selkirk Loop
- Mountains to Sound Greenway – I-90
- Stevens Pass Greenway
- Strait of Juan de Fuca Highway – SR 112
- White Pass Scenic Byway

State Scenic Byways are roads with statewide interest; WSDOT designates and manages State Scenic Byways. Some State Scenic Byways may be designated on portions of National Scenic Byways. Washington has 21 State Scenic Byways that crisscross the entire state (WSDOT, 2015a):[2]

- Cape Flattery Tribal Scenic Byway
- Cascade Loop
- Cascade Valleys
- Chuckanut Drive
- Columbia River Gorge
- Cranberry Coast Scenic Byway
- Hidden Coast Scenic Byway
- Lewis and Clark Trail
- Mt. Baker Scenic Byway
- North Cascades Scenic Highway
- North Pend Oreille Scenic Byway
- Okanogan Trails
- Pacific Coast Scenic Byway
- Palouse Scenic Byway
- San Juan Islands Scenic Byway
- Sherman Pass Scenic Byway
- Spirit Lake Memorial Highway
- Swiftwater Corridor
- Whidbey Scenic Isle Way
- Yakama Scenic Byway
- Yakima River Canyon

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

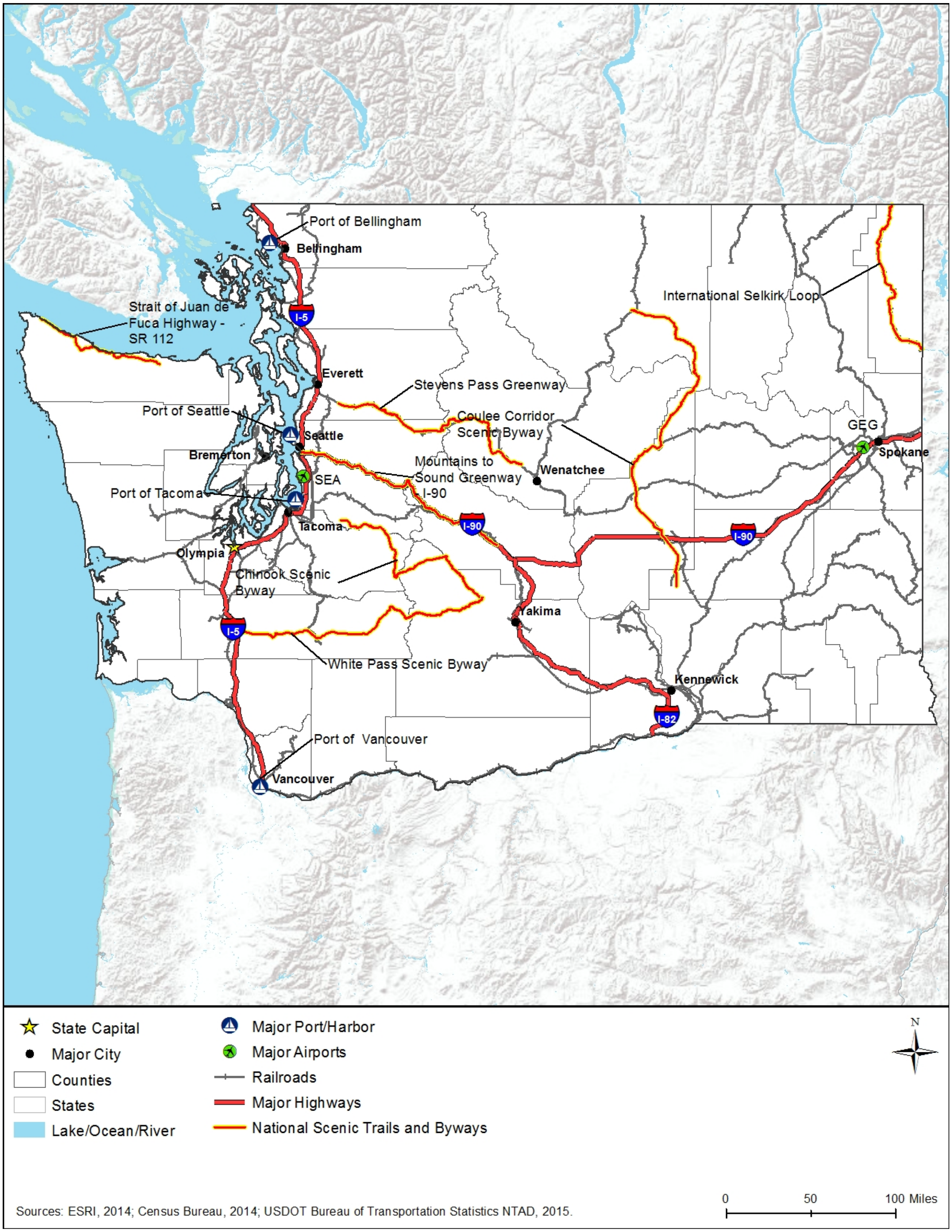

Figure 8.1.1-1: Washington Transportation Networks

Airports

Seattle-Tacoma International Airport (SEA) and Spokane International Airport (GEG), in addition to some smaller airports, provide public air service to the state.

- SEA is 13 miles south of downtown Seattle. In 2015, SEA served 42,340,537 passengers, facilitated 381,408 aircraft operations, and moved 332,636 metric tons of cargo (SEA 2015). In 2014, SEA was the 13th busiest airport in the nation in terms of the number of passengers served (FAA 2015b) and the 18th busiest in the nation in terms of the amount of cargo moved (FAA, 2015c).
- GEG is 5 miles west of downtown Spokane. In 2014, GEG served 1,445,572 passenger enplanements and moved 402,626,480 pounds of cargo (FAA, 2015c). That same year, GEG was the 71st busiest airport in the nation in terms of the number of passengers served (FAA 2015b) and the 54th busiest in the nation in terms of the amount of cargo moved (FAA, 2015c).

Figure 8.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 8.1.7, Airspace, provides detail on airports and airspace in Washington.

Rail Networks

Washington is connected to a network of passenger rail (Amtrak), public transportation (commuter rail), and freight rail. Figure 8.1.1-1 illustrates the major transportation networks, including rail lines, in Washington.

Amtrak runs three lines through Washington: Cascades, Coast Starlight, and Empire Builder. The Cascades runs multiple times per day between Eugene in central Oregon and Vancouver, British Columbia, making 12 stops in Washington; in 2012, Amtrak served 836,000 passengers on this line (WSDOT, 2014). The Coast Starlight provides daily service between Seattle and Los Angeles, with six stops in Washington. The Empire Builder runs every day between Chicago and Portland or Seattle, making 11 stops in Washington. Table 8.1.1-3 provides a complete list of Amtrak lines that run through Washington.

Table 8.1.1-3: Amtrak Train Routes Serving Washington

Route	Starting Point	Ending Point	Length of Trip	Major Cities Served in Washington
Cascades	Vancouver, BC	Eugene OR	10 hours 25 minutes	Vancouver, Tacoma, Seattle, Bellingham
Coast Starlight	Seattle, WA	Los Angeles, CA	35 hours	Seattle, Tacoma, Vancouver
Empire Builder	Chicago, IL	Portland, OR or Seattle, WA	46 hours (either end point)	Spokane, Vancouver, Seattle

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

Sound Transit provides commuter train and light rail train services to the Seattle and Tacoma metropolitan areas. The Sounder train is a commuter rail with two lines serving the communities to the north and south of Seattle at 13 stations (Sound Transit, 2015a). In 2012, Sounder served 2.8 million passengers (WSDOT, 2014). The Link is a light rail system with one line running between downtown Seattle and Sea-Tac Airport, stopping at 11 stations along the way (Sound

Transit, 2015b). The Tacoma Link is another light rail system that serves downtown Tacoma, along 1.6 miles of track with six stops (Sound Transit, 2015b).

Two Class I freight rail[3] companies operate in Washington: BNSF Railway and Union Pacific Railroad; combined, these two railroads own 60 percent of the railroad track in Washington. In addition, 24 Class III[4] railroads operate in Washington: 18 local railroads plus 6 switching and terminal railroads; combined, these 24 railroads operate on 1,457 miles of track in the state. In 2007, freight rail moved 83 million tons of freight in Washington, which was 41 percent of all of the state's freight rail movement. One-third of freight rail movement in Washington is pass-through traffic, with starting and ending points outside the state (WSDOT, 2014).

Harbors and Ports

Washington is home to the Puget Sound (an inlet of the Pacific Ocean), in its northwest corner. Both Puget Sound and the Pacific coastline are dotted with nautical facilities, including recreational marinas and shipping ports. The Ports of Tacoma, Seattle, and Bellingham all sit on the Puget Sound and provide shipping and cargo handling functions that are vital to the state's economy. The Port of Tacoma is found at the lower end of the Sound, on Commencement Bay, and can be reached overland via I-5 or I-705 (NW Seaport Alliance, 2015a). In August of 2015, the Port of Tacoma and the Port of Seattle created the Northwest Seaport Alliance "to unify management of our marine cargo facilities and business to strengthen the Puget Sound gateway and attract more marine cargo and jobs for the region." (NW Seaport Alliance, 2015b) The Northwest Seaport Alliance operates as a governing authority for the two ports as equal members, while each port still maintains their own elected commissioners (NW Seaport Alliance, 2015b). The Port of Seattle is found on the eastern side of the Sound, along the edge of the City of Seattle, and can be reached via I-5 (NW Seaport Alliance, 2015a). The Port of Bellingham is in northern Washington, on the east side of Bellingham Bay, a part of the Puget Sound. Over land, I-5 runs just to the east of the port (Port of Bellingham, 2015a). Lastly, the Port of Vancouver is along the Columbia River, where Washington and Oregon have their border. I-5 runs to the southwest of the port (Port of Vancouver USA, 2015a).

The Northwest Seaport Alliance, a partnership composed of the now partially autonomous Ports of Tacoma and Seattle "is a major center for containers, bulk, breakbulk, project/heavy-lift cargoes, automobiles and trucks," as well as being connected to "the second-largest concentration of distribution centers on the West Coast" (NW Seaport Alliance, 2015c). The alliance of these two ports involves some shared properties, although some are retained by their respective ports (NW Seaport Alliance, 2015c). Data for the year 2014 indicated that container cargo and grain were two of the Seaport Alliance's most popular items (NW Seaport Alliance, 2015d). Rail services provided by BNSF Railway and Union Pacific Railroad help move this cargo inland to points across the continent (NW Seaport Alliance, 2015e). In 2013, two years prior to the creation of the Northwest Seaport Alliance, the U.S. Census Bureau reported that the Port of Tacoma imported $37.5 billion worth of cargo goods, weighing 6.8 million tons; and

[3] Annual operating revenue of more than $433.2 million (WSDOT, 2014).

[4] Revenues of less than $34.7 million and are engaged in line-haul transportation (WSDOT, 2014).

exported $11.2 billion, weighing 11.1 million tons (U.S. Census Bureau, 2015c). Also in 2013, the Port of Seattle brought in $21.2 billion in cargo during 2013, weighing 7.7 million tons; and exported $7.4 billion weighing 8.8 million tons (U.S. Census Bureau, 2015c).

The Port of Bellingham and its Bellingham Shipping Terminal are specialists in handling break bulk cargo, or goods that must be loaded individually instead of in bulk. The area includes "1,250 feet of dock space, over 85,000 square feet of covered storage and 35 acres of available upland" (Port of Bellingham, 2015b). Cargo travels "by vessel, barge, or truck" and the Port is only 22 miles from the Canadian Border (Port of Bellingham, 2015c). In 2013, the Port imported $2.8 billion, weighing 4.4 million tons, and exported $488 million weighing 0.58 million tons (U.S. Census Bureau, 2015c).

"The Port of Vancouver is the furthest inland deep-water port on the Columbia River – allowing ocean-going vessels to cost-effectively both load and discharge their cargoes" (Port of Vancouver USA, 2015b). Rail service is provided by BNSF Railway and Union Pacific (Port of Vancouver USA, 2015c). Cargo moved by the port includes wheat, soybeans, and corn, which can be housed in the terminal 2-grain elevator wharf (Port of Vancouver USA, 2015d). They also handle "steel, pulp, plywood, aluminum, trucks, forest products, containers, and yachts" (Port of Vancouver USA, 2015e). The Port of Vancouver imported $1.5 billion in goods, weighing 0.6 million tons, and exported $2.1 billion weighing 4.2 million tons (U.S. Census Bureau, 2015c).

8.1.1.4. Public Safety Services

Washington public safety services generally consist of public safety infrastructure and first responder personnel aligned with the demographics of the state. Table 8.1.1-4 presents Washington's key demographics including population; households; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 8.1.9, Socioeconomics.

Table 8.1.1-4: Key Washington Indicators

Washington Indicators	
Estimated Population (2015)	7,170,351
Land Area (square miles) (2010)	66,455.52
Population Density (persons per sq. mile) (2010)	101.2
Municipal Governments (2013)	281

Sources: (U.S. Census Bureau, 2015a) (U.S. Census Bureau, 2013b)

Table 8.1.1-5 presents Washington's public safety infrastructure, including fire and police stations, medical facilities, schools and libraries, and airport facilities. School and library counts have been included as these facilities can serve as possible evacuation centers. Table 8.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 8.1.1-5: Public Safety Infrastructure in Washington by Type

Infrastructure Type	Number
Fire and Rescue Stations [a]	1,256
Law Enforcement Agencies [b]	260
Fire Departments [c]	399

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

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

Table 8.1.1-6: First Responder Personnel in Washington by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers [a]	1,720
Fire and Rescue Personnel [b]	19,882
Law Enforcement Personnel [c]	17,602
Emergency Medical Technicians and Paramedics [d e]	2,880

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

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

8.1.1.5. Telecommunications Resources

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

Communications throughout the state are based on a variety of publicly and commercially owned technologies, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems providing voice, data, and video services (BLS, 2016a). Figure 8.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including a Long Term Evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).

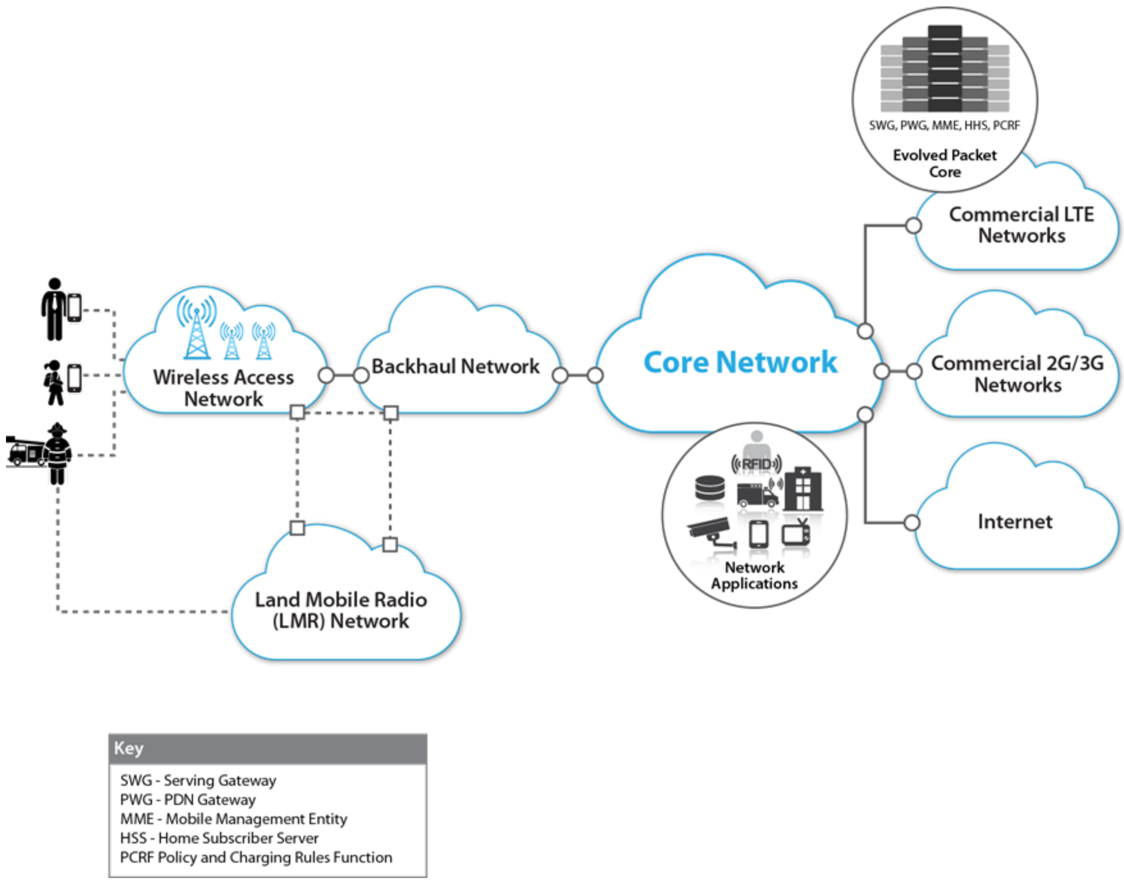

Figure 8.1.1-2: Wireless Network Configuration

Prepared by: Booz Allen Hamilton

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as LTE (see Section 8.1.1), has the potential to provide users with better coverage, while offering additional capacity and enabling the use of new applications that would 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 scale, which is national (NIST, 2015). Historically, there have been many challenges and impediments to timely and effective sharing of information. Chief among these factors impacting information sharing are: network coverage gaps, land mobile radio system infrastructure diversity, insufficient budgets, and diverse radio frequencies.

Communication interoperability has also been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the U.S. and specifically in Washington. There are five key reasons why public safety agencies often cannot connect through existing communications (NTFI, 2005):

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

To enable the public safety community to incorporate disparate Land Mobile Radio networks with a nationwide public safety LTE broadband network, the U.S. Department of Commerce Public Safety Communications Research 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).

Like most states, Washington's public safety LMR network environment is facing transition and reflects the challenges of the need for greater system capabilities and integration to achieve its vision of increased interoperability across the number of local/county as well as diverse regional systems in the state. According to the state's Statewide Communication Interoperability Plan (SCIP), Washington's vison is to implement a "system-of-systems" approach to support public safety voice communications through the coordinated use of multiple frequencies and increased reliance on the 700 MHz band (Washington State Interoperability Executive Committee, 2008).

The Washington State Patrol acts as the lead agency overseeing interoperability initiatives including ensuring identification and oversight of enabling new infrastructure such as the deployment of Radio Over Internet Protocol (RoIP) gateways to enhance cross-frequency communication in the state (Washington State Interoperability Executive Committee, 2008).

Statewide/Multi-County Public Safety Networks

Similar to other larger states such as California and Texas, Washington has implemented a "system-of-systems" approach to addressing its interoperability and public safety LMR system integration and coordination needs. The state's approach is coordinated out of the primary radio network control center in Olympia. The center oversees the state's portfolio of its diverse radio tower sites. The sites are grouped from low, medium, and high density based on the traffic concentration handled, as well as number of channels and wireless equipment deployed at each site. Figure 8.1.1-3 below provides a snapshot of the state's LMR statewide digital transport support infrastructure for public safety (Washington State Interoperability Executive Committee, 2008).

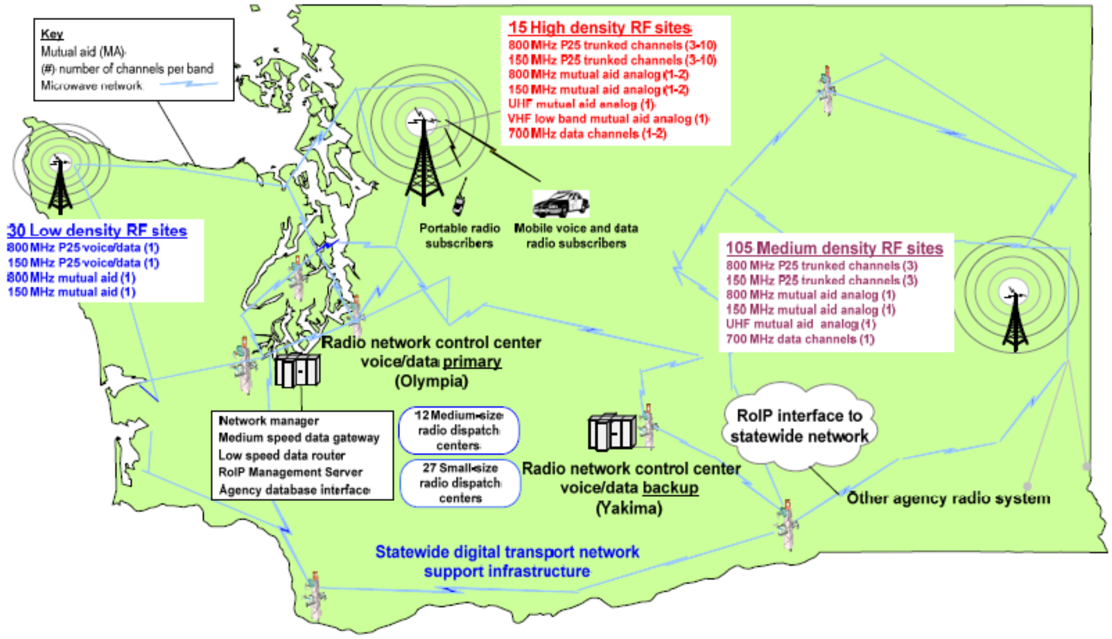

Figure 8.1.1-3: Washington LMR Statewide Digital Transport Network Support Infrastructure

Source: (Washington State Interoperability Executive Committee, 2008)

Washington's Counties are grouped into nine Regional Homeland Security Coordination Districts (RHSCDs) which are used for regional emergency response and LMR communications coordination and interoperability planning. Figure 8.1.1-4 below illustrates these districts (Washington State Interoperability Executive Committee, 2008).

Figure 8.1.1-4: Washington Regional Homeland Security Coordination Districts

Source: (Washington State Interoperability Executive Committee, 2008)

According to the state's SCIP there were 170 towers[5] across these nine regions. These regional site assets support local/county, regional, and state LMR public safety agencies and emergency communications needs in Washington. Figure 8.1.1-5 below illustrates the allocation of these towers by their respective regions (Washington State Interoperability Executive Committee, 2008).

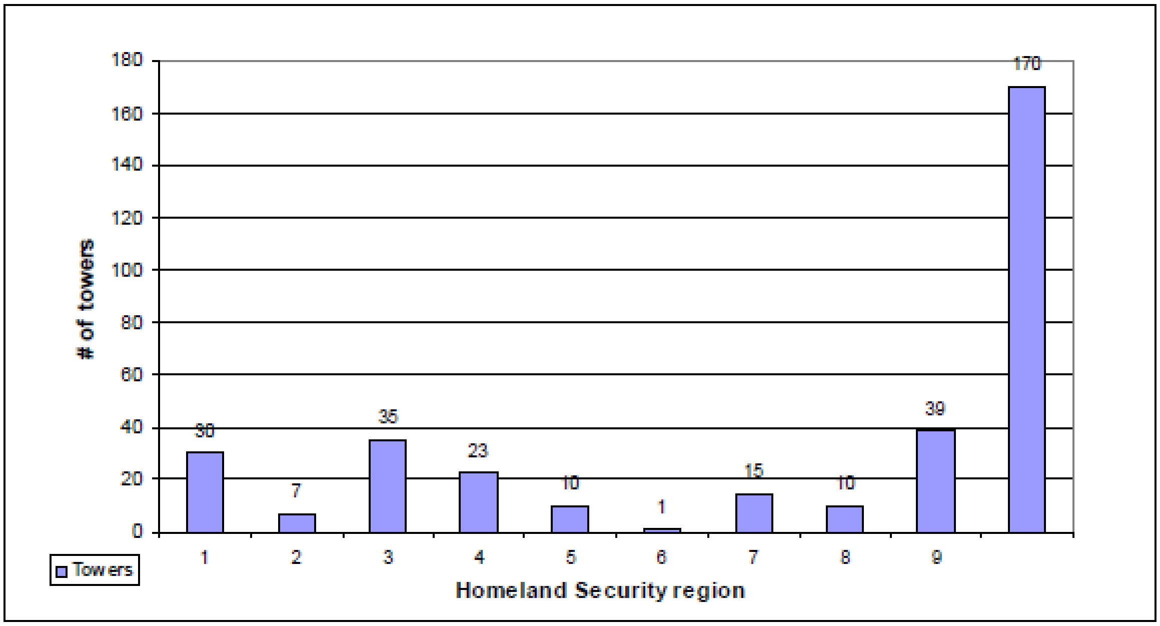

Figure 8.1.1-5: Washington Homeland Security Region Towers[6]

Source: (Washington State Interoperability Executive Committee, 2008)

According to Washington's SCIP, the state's overall approach to implementing LMR interoperability is largely centered on 700 MHz. However, additional statewide systems are available in the state to support statewide interagency and interoperability communications including: the Law Enforcement Radio Network (LERN), the State Fire Control Channel (REDNET/FIRECOM), and the medical/hospital MED-COM Network—all of which operate on Very High Frequency (VHF) [7] frequencies (Washington State Interoperability Executive Committee, 2008).

County/City Public Safety Networks

In Washington, county and local public safety communications have been supported by a diverse set of systems and frequencies including VHF, Ultra High Frequency (UHF),[8] 700 MHz, and 800 MHz across the state's counties and cities. There continues to be high diversity in the types and frequencies of LMR systems adopted by public safety departments. In its SCIP, the state

[5] A total of 315 towers were reported by Homeland Security regions and state agencies. This total consists of 170 towers utilized in Regions 1 through 9, plus an additional 145 towers for state agencies. (Washington State Interoperability Executive Committee, 2008).

[6] The last column of Figure 8.1.1-5 represents Region 10; error with source figure.

[7] VHF band covers frequencies ranging from 30 MHz to 300 MHz (NTIA, 2005).

[8] UHF band covers frequencies ranging from 300 MHz to 3000 MHz (NTIA, 2005).

highlighted the fragmentation and diversity of its LMR systems and the challenges of achieving improved interoperability commenting, "The state of Washington has no integrated, centrally managed, and mutually supported statewide common land mobile radio system. Although various radio and data systems exist across the state, some urban regions enjoy a high degree of local/regional interoperability. But even in these area systems are disparate, fragmented and are at different stages of their lifecycle. Future systems are not collaboratively planned to minimize cost, reduce duplication of effort and share infrastructure" (Washington State Interoperability Executive Committee, 2008).

In spite of the diversity of the LMR systems and the use of multiple frequencies in Washington there are a number of county wide digital P25 networks in use in the state, such as the Grant County Multiagency Communications system. These digital Project 25 (P25) systems can deliver both increased application capabilities in areas such new data services, as well as enable the potential for enhanced interoperability—both interagency at local incidents and across multiple regions in many cases (Project 25.org, 2015a) (Project 25.org, 2015b).

There are nine public safety digital P25 systems providing coverage in Washington and Table 8.1.1-7 below lists these LMR systems and their operating frequencies. With the exception of the DOJ VHF system, all of these systems operate on either 700 MHz, 800 MHz, or both frequencies (Project 25.org, 2015a) (Project 25.org, 2015b).

Table 8.1.1-7: Washington State Public Safety P25 Networks

Washington State P25 Public Safety Systems	Frequency Band
Benton County Emergency Services P25 Radio System	800 MHz
Grant County Multiagency Communications	800 MHz
Snohomish County Emergency Radio (SERS)	800 MHz
Spokane Regional Emergency Communications	800 MHz
USDOJ: Integrated Wireless Network (IWIN)	VHF
Oregon State Radio Project	700 MHz
South Sound 911	700 MHz
Tacoma/Puyallup Public Safety Radio System (PSRS)	700 MHz/800MHz
Washington State Patrol Department of Transportation (WSPDOT)	700 MHz

Source: (FCC, 2014a) (FCC, 2014b)

Public Safety Answering Points

According to the Federal Communication Commission's (FCC) Master PSAP registry there are 127 PSAPs in Washington serving Washington's 39 counties (FCC, 2015b).

Commercial Telecommunications Infrastructure

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

Carriers, Coverage, and Subscribers

Washington's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems as well as cable submarine systems for international connectivity. Table 8.1.1-8 presents the number of providers of switched access[9] lines, Internet access[10], and mobile wireless services including coverage.

Table 8.1.1-8: Telecommunications Access Providers and Coverage in Washington State as of December 31, 2013

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access line [a]	165	97.9% of households [b]
Internet access [c]	93	68% of households
Mobile wireless [d]	43	93% of population

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

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

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

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

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

Table 8.1.1-9 shows the wireless providers in Washington along with their geographic coverage. The following four maps Figure 8.1.1-6 to Figure 8.1.1-9 show: AT&T and Verizon's coverage; Startouch Inc. and U.S. Cellular's coverage; Sprint and T-Mobile's coverage; and the coverage of all other providers with less than 5 percent coverage area, respectively.

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

Table 8.1.1-9: Wireless Telecommunications Coverage by Providers in Washington

Wireless Telecommunications Providers	Coverage
AT&T Mobility LLC	34.02%
Verizon Wireless	28.38%
Startouch, Inc.	16.94%
Sprint	12.03%
U.S. Cellular	9.83%
T-Mobile	7.69%
Other[a]	12.93%

Source: (NTIA, 2014)

[a]Other: Provider with less than 5 percent coverage area. Providers include: AIR-PIPE; Inland Cellular; Odessa Office Equipment; Spectrum Online Services LLC; PocketiNet Communications, Inc.; Desert Winds Wireless; Ptera; Columbia Energy, LLC; Cricket Wireless; Public Utility District No. 1 of Douglas County; Benton REA PowerNET; Wabband; Wind Wireless; First Step Internet, LLC; Cascade Networks, Inc.; Inland Telephone Company; Air Speed Internet, LLC; PogoZone; SawNet; Tanager Telecom; Gorge Networks; EasyStreet Online; Skynet Broadband; CresComm Broadband; Iron Goat Networks, LLC; Rock Island Technology Solutions; Nikola Engineering Inc.; Rebus Communications, LLC; Stephouse Networks; Benton PUD; Dash Wireless; Franklin County PUD #1; City of Port Angeles; Frontier Broadband; CSS Communications; Mason County PUD #3; Nextlink Wireless, Inc.

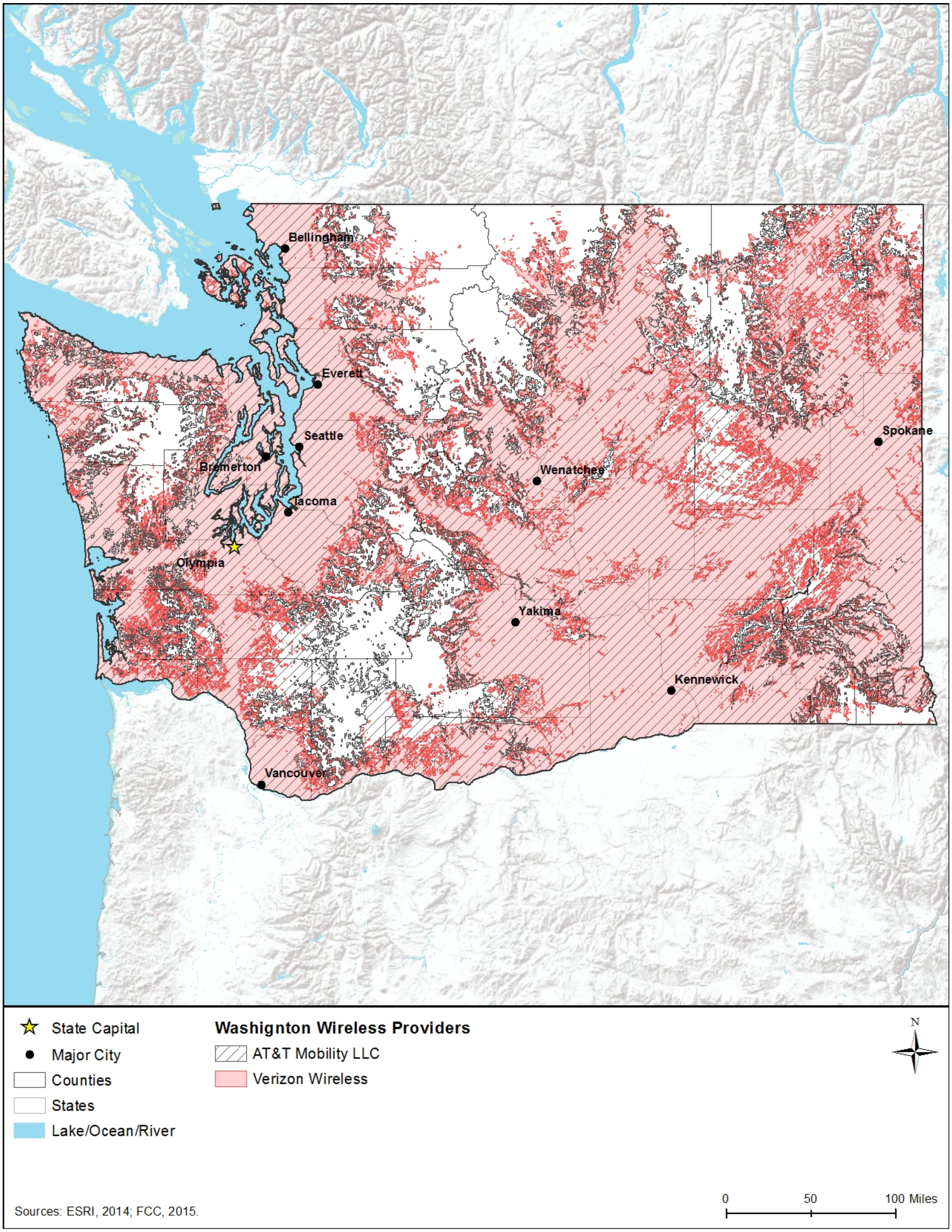

Figure 8.1.1-6: Top Wireless Providers Availability in Washington

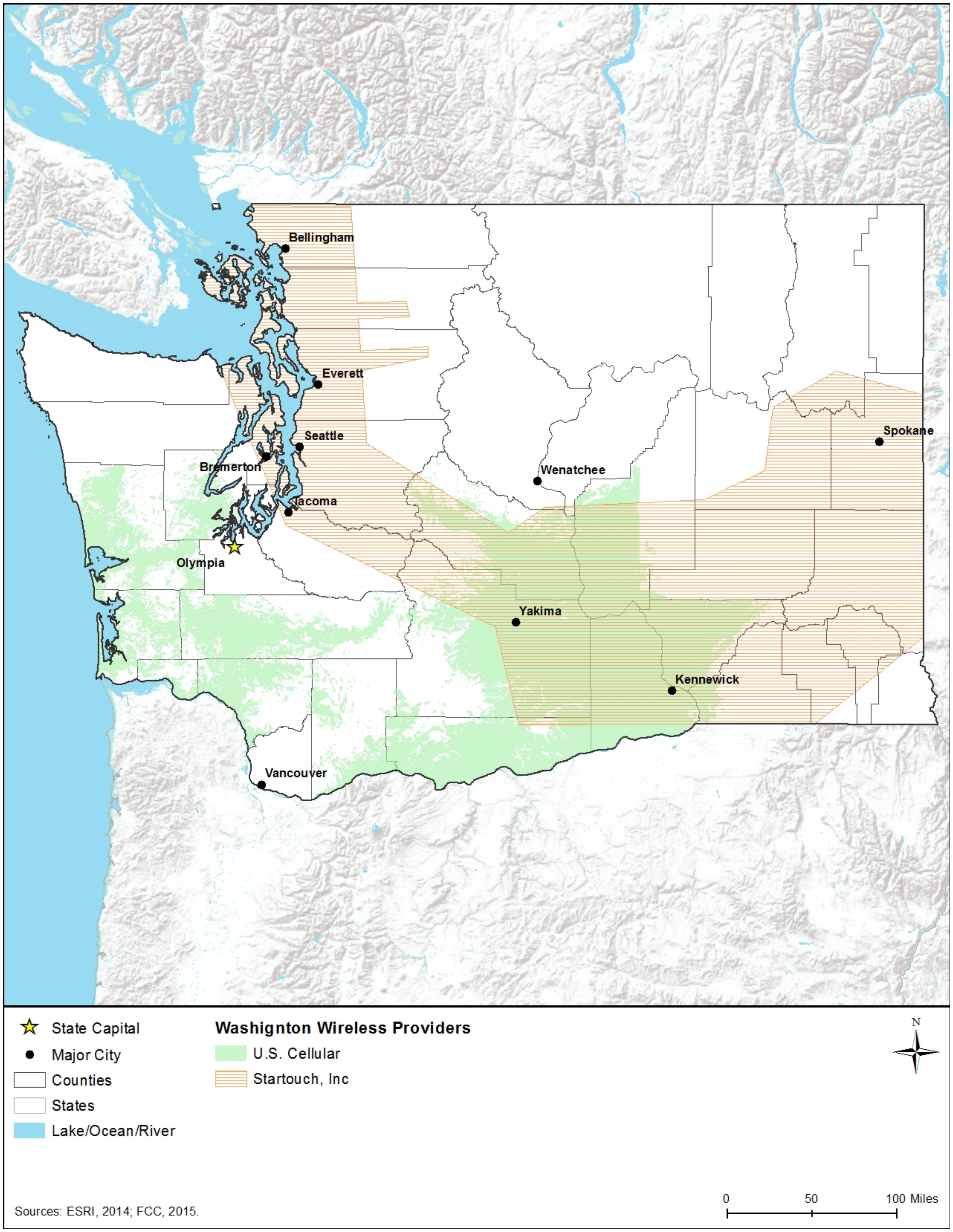

Figure 8.1.1-7: Startouch Inc. and U.S. Cellular Wireless Availability in Washington

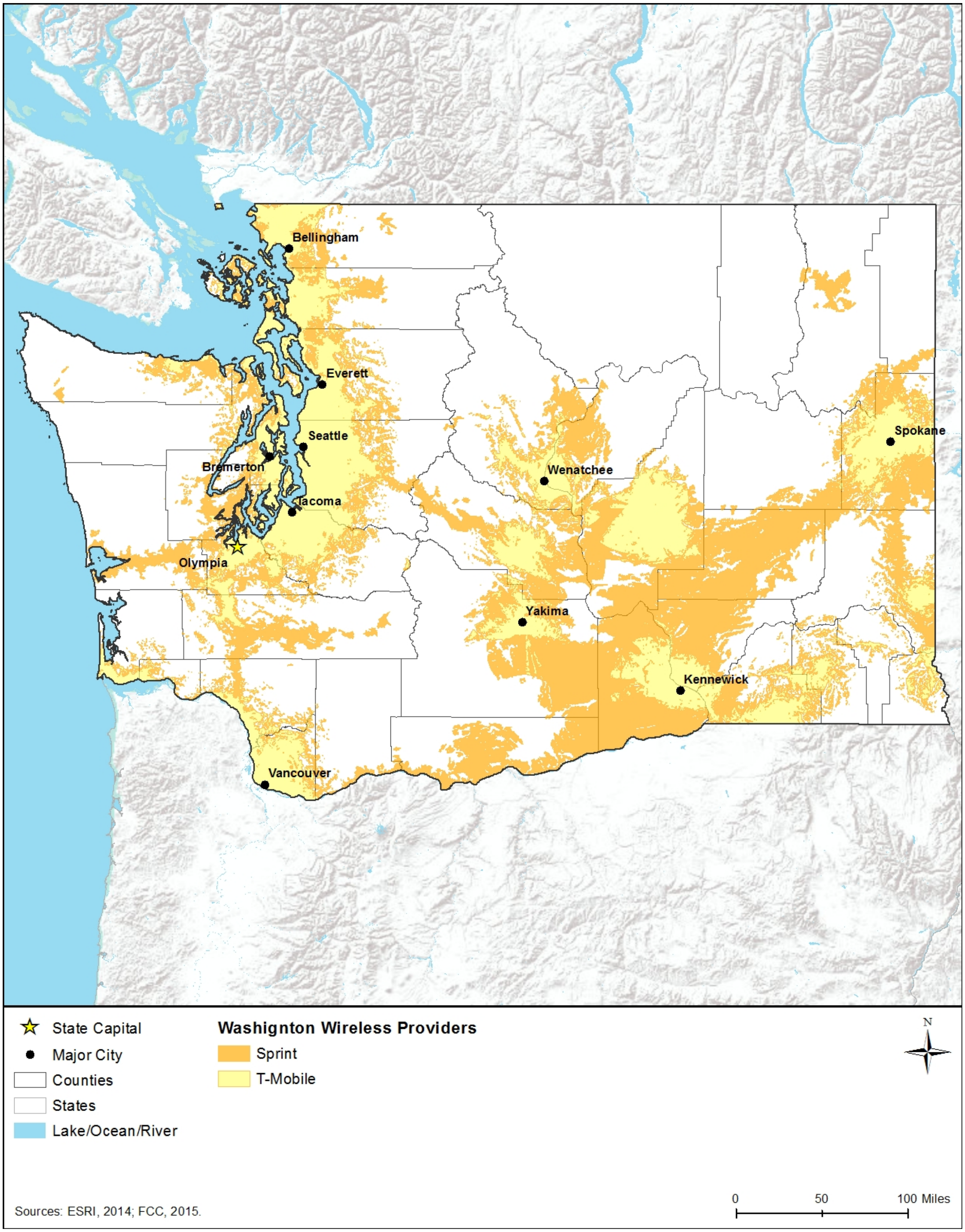

Figure 8.1.1-8: Sprint and T-Mobile Wireless Availability in Washington

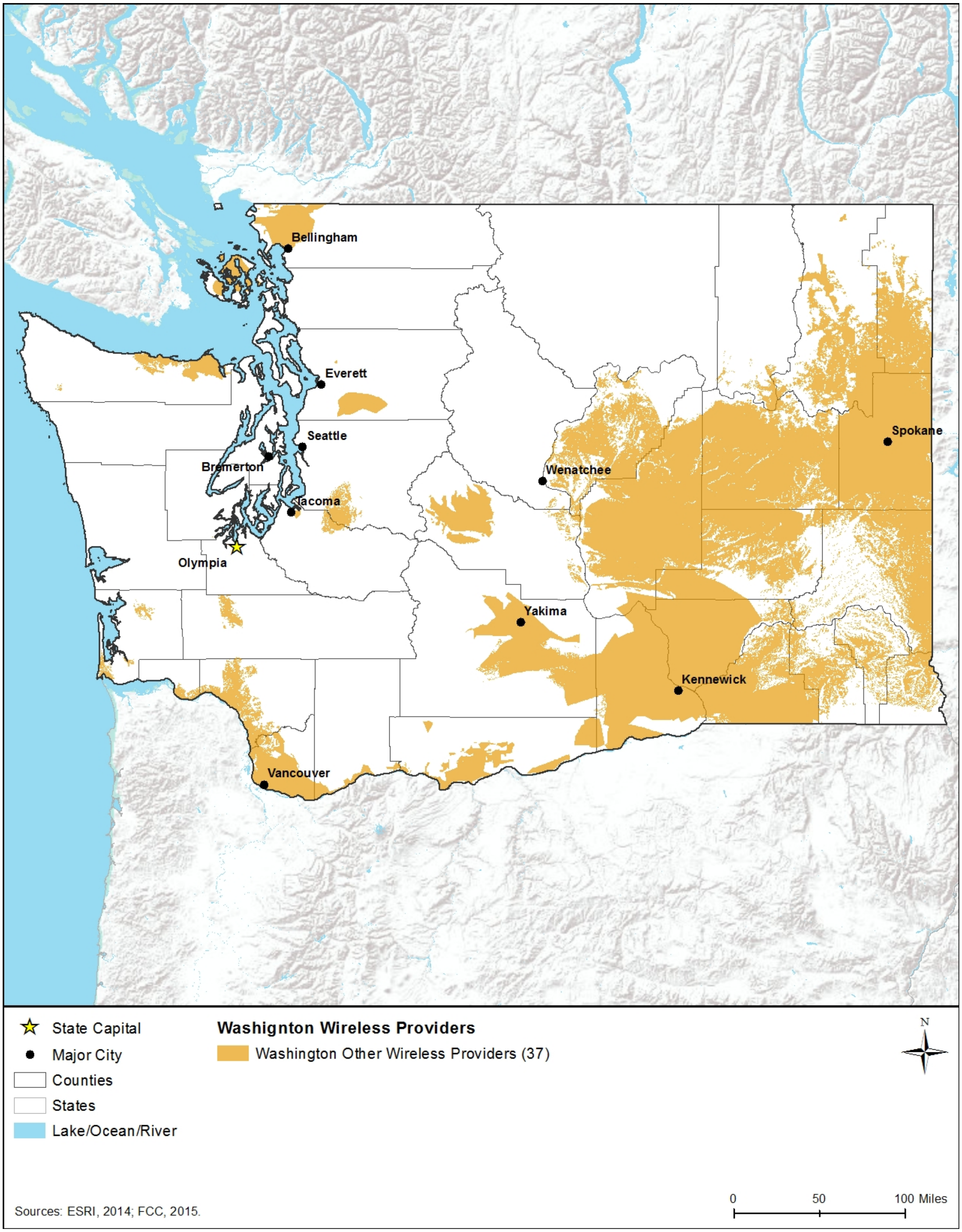

Figure 8.1.1-9: Other Provider Wireless Availability in Washington

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 8.1.1-10 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 8.1.1-10: Types of Towers

Telecommunications tower infrastructure proliferates throughout Washington, although tower infrastructure is concentrated in the higher and more densely populated areas of Washington; Bellingham, Everett, Seattle, Bremerton, Tacoma, Olympia, Vancouver, Wenatchee, Yakima, Kennewick, and Spokane (U.S. Census Bureau, 2015b). Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC[11] (FCC, 2016b). Table 8.1.1-10 presents the number of towers (including broadcast towers) registered with the FCC in

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

Washington, by tower types, and Figure 8.1.1-11 presents the location of those structures, as of June 2016.

Table 8.1.1-10: Number of Commercial Towers in Washington by Type

Constructed[a] Towers[b]		Constructed Monopole Towers	
100ft and over	40	100ft and over	0
75ft – 100ft	104	75ft – 100ft	0
50ft – 75ft	204	50ft – 75ft	12
25ft – 50ft	477	25ft – 50ft	125
25ft and below	249	25ft and below	39
Subtotal	**1,074**	**Subtotal**	**176**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	5	100ft and over	0
75ft – 100ft	19	75ft – 100ft	2
50ft – 75ft	8	50ft – 75ft	5
25ft – 50ft	7	25ft – 50ft	54
25ft and below	1	25ft and below	4
Subtotal	**40**	**Subtotal**	**65**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	1	100ft and over	0
75ft – 100ft	25	75ft – 100ft	0
50ft – 75ft	73	50ft – 75ft	0
25ft – 50ft	46	25ft – 50ft	1
25ft and below	16	25ft and below	0
Subtotal	**161**	**Subtotal**	**1**
Constructed Tanks[d]			
Tanks	10		
Subtotal	**10**		
Total All Tower Structures		**1,527**	

Source: (FCC, 2015c)

[a] Planned construction or modification has been completed. Results will return only those antenna structures that the FCC has been notified are physically built or planned modifications/alterations to a structure have been completed (FCC, 2015d).
[b] Self standing or guyed (anchored) structure used for communication purposes (FCC 2012).
[c] Multiple constructed structures per antenna registration (FCC, 2016c).
[d] Any type of tank – water, gas, etc. with a constructed antenna (FCC, 2016c).

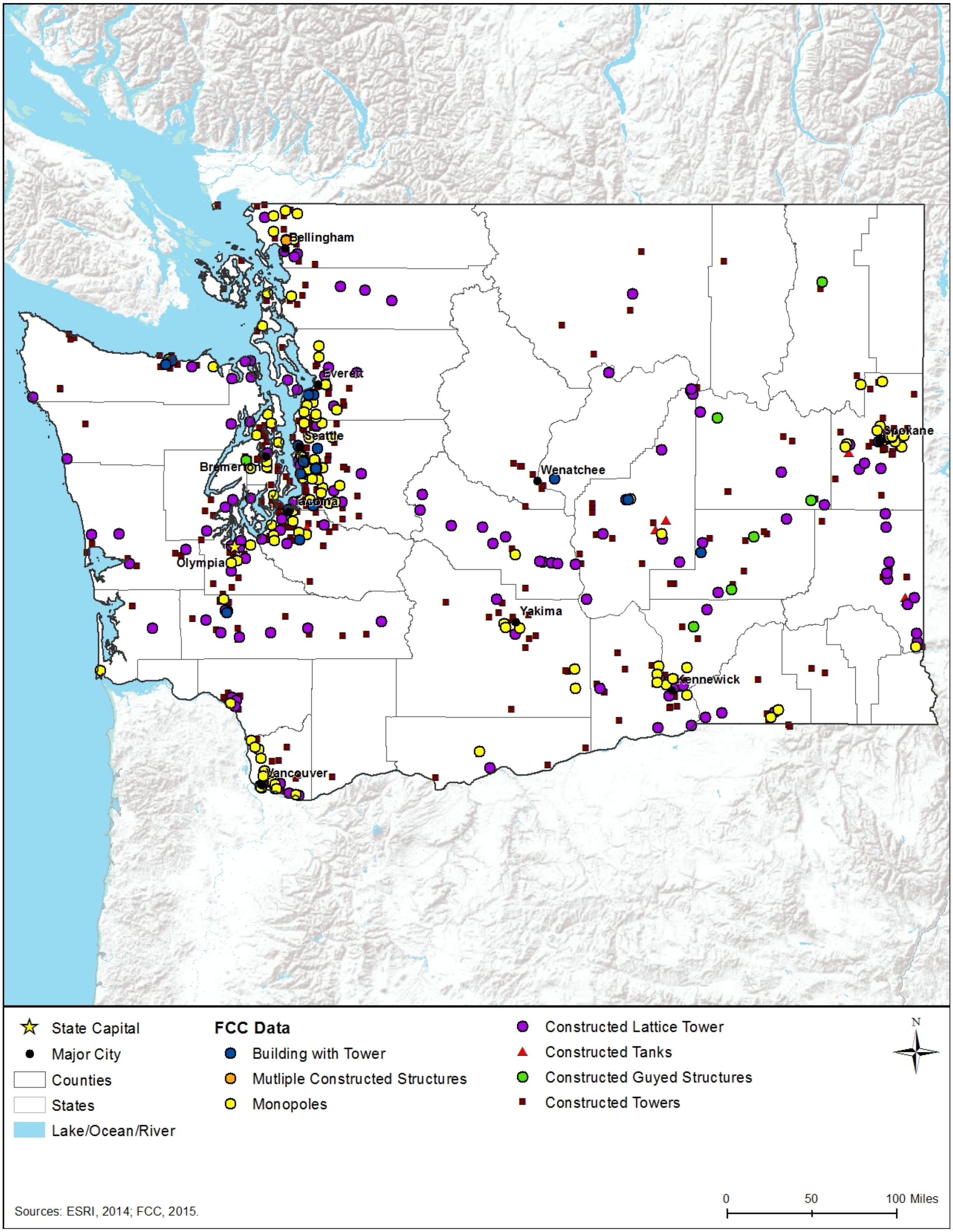

Figure 8.1.1-11: FCC Tower Structure Locations in Washington

Fiber Optic Plant (Cables)

Fiber optic plant, or cables, can be buried directly in the ground; pulled, blown, or floated into ducts, conduits, or innerduct (flexible plastic protective sleeves or tubes); placed under water; or installed aerially between poles, typically on utility rights-of-way. A fiber optic network includes an access network consisting of a central office, distribution and feeder plant (cables of various sizes directly leaving a central office and splitting to connect users to the network), and a user location, as shown in Figure 8.1.1-12. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).

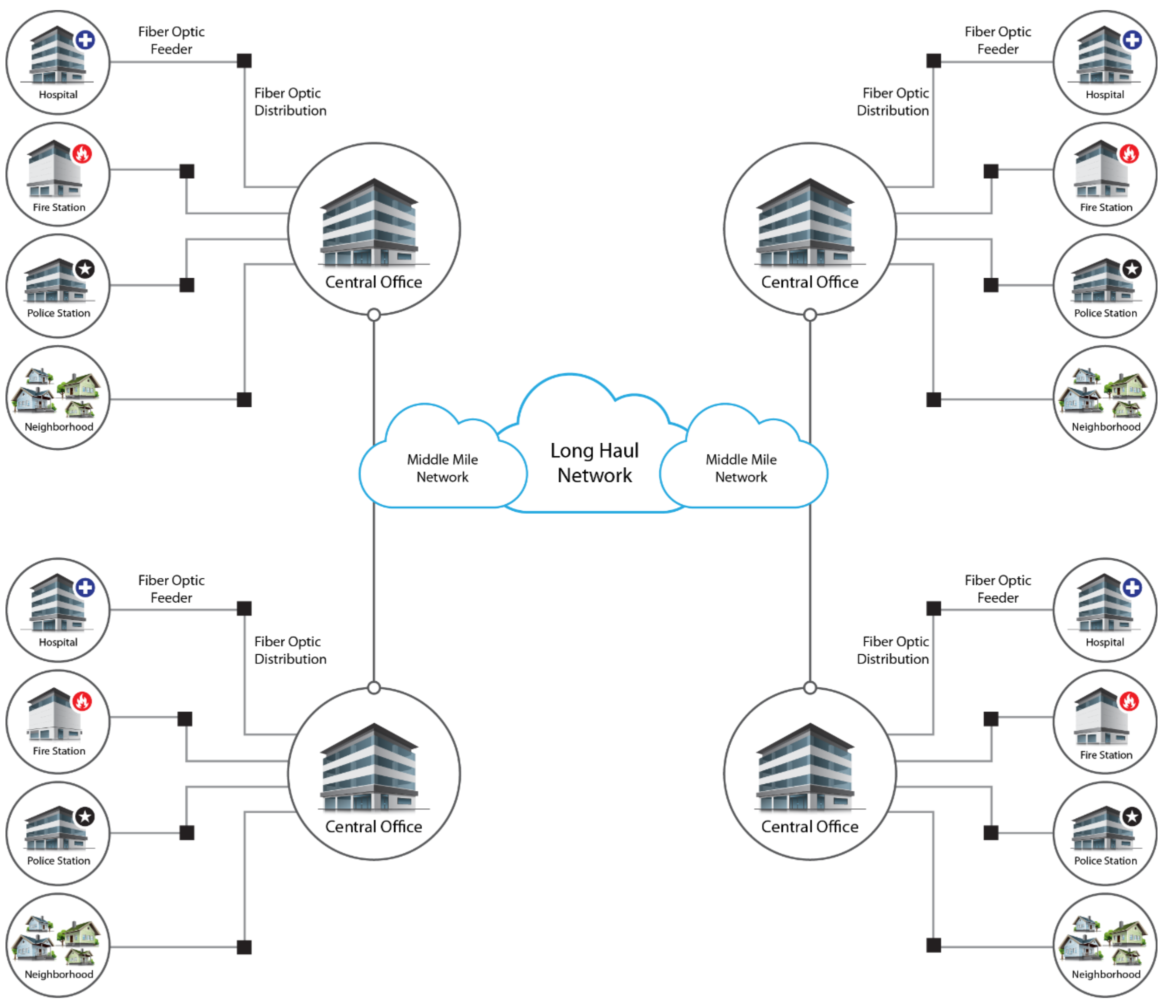

Figure 8.1.1-12: Typical Fiber Optic Network in Washington

Source: (ITU-T, 2012)

Prepared by: Booz Allen Hamilton

Last Mile Fiber Assets

In Washington, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Washington there are 61 fiber providers that offer service in the state, as listed in Table 8.1.1-11. Figure 8.1.1-13 shows coverage for CenturyLink and Frontier Communications Northwest Inc., Figure 8.1.1-14 shows coverage for Comcast and MegaPath Corporation, and Figure 8.1.1-15 shows coverage for all other providers with less than 5 percent coverage, respectively.[12]

Table 8.1.1-11: Fiber Provider Coverage

Fiber Provider	Coverage
CenturyLink	3.86%
Frontier Communications Northwest, Inc.	2.14%
Comcast	2.09%
MegaPath Corporation	1.10%
Other[a]	8.72%

Source: (NTIA, 2014)

[a]Other: Provider with less than 5 percent coverage area. Providers include: Wave Broadband; Charter Communications Inc.; LSN; Integra Telecom; FairPoint Communications; PUD Pend Oreille; Scatter Creek InfoNet, Inc.; TDS Telecom; SawNet; Tanager Telecom; Pioneer Communications Company; Mason County PUD #3; Hood Canal Communications; Inland Telephone Company; Public Utility District of Chelan County; Public Utility District of Grays Harbor County; Benton PUD; Public Utility District of Okanogan County; Public Utility District of Grant County; St. John Telephone; RTI Pend Oreille Telecom; Rainier Connect; Click! Network; Franklin County PUD #1; PUD Kitsap; Wahkiakum West Television, Inc.; Toledo Telenet; Cascade Networks, Inc.; Cheney Medical Lake TV Cable; Whidbey Telecom; Level 3 Communications, LLC; Northland Communications; Island Network; XO Communications Services, Inc. (Affiliated Entity); Coast Communications Co. Inc.; Public Utility District No. 1 of Douglas County; Axxis Communications; Time Warner Cable; San Juan Cable, Inc.; Cable One PUD Pacific; TW Telecom of Washington LLC; Skyline Telecom, Inc.; PogoZone; R&R Cable Company; First Step Internet, LLC; Northstar Broadband; Public Utility District No. 1 of Skagit County; Zayo Group, LLC; Highlands Fiber Network; Public Utility District of Clallam County; Colfax Cable; TV Association of Republic; CSS Communications; AIR-PIPE; Hat Island Telephone Company; Cogent Communications, Inc.

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

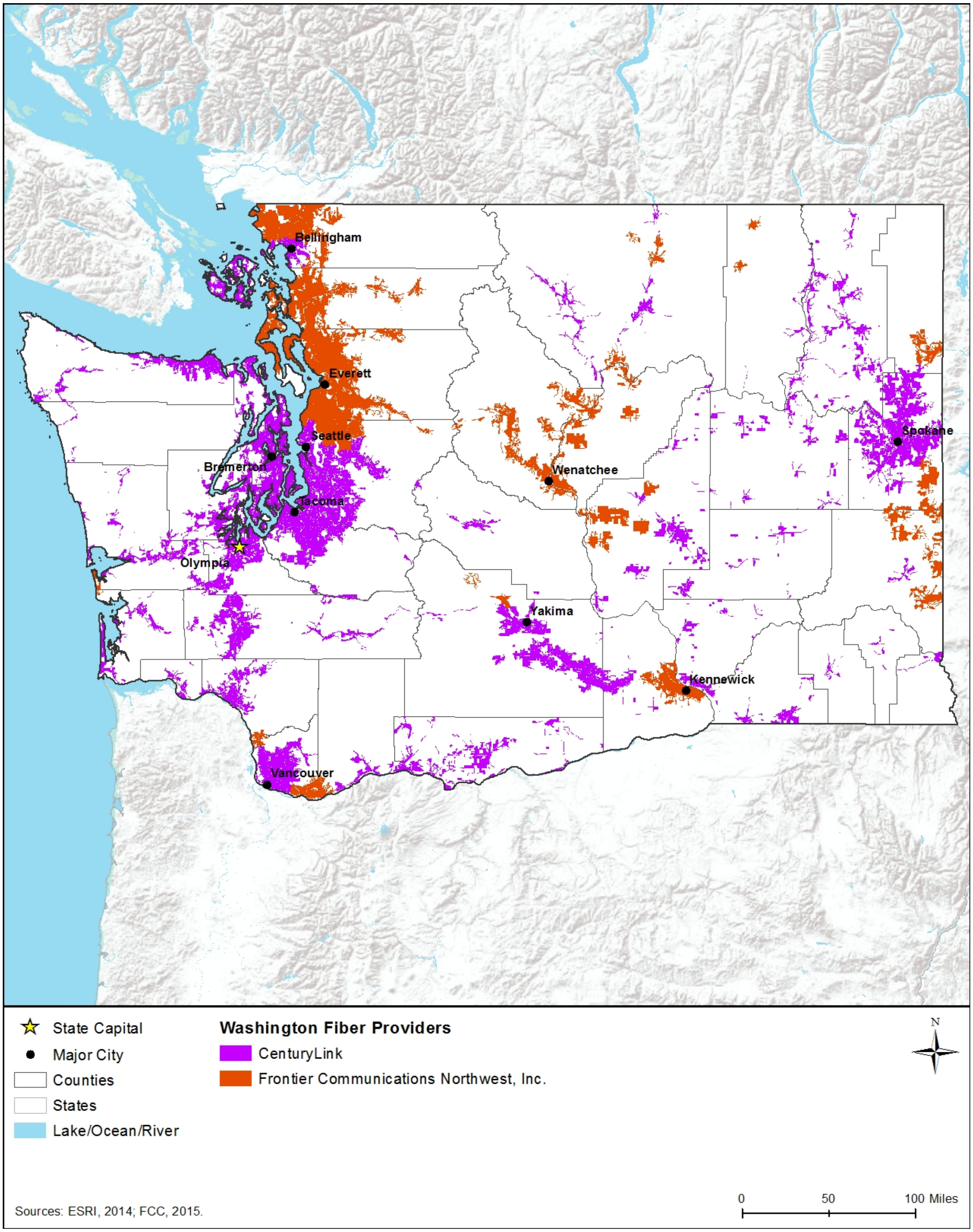

Figure 8.1.1-13: Fiber Availability in Washington for CenturyLink and Frontier Communications Northwest Inc.

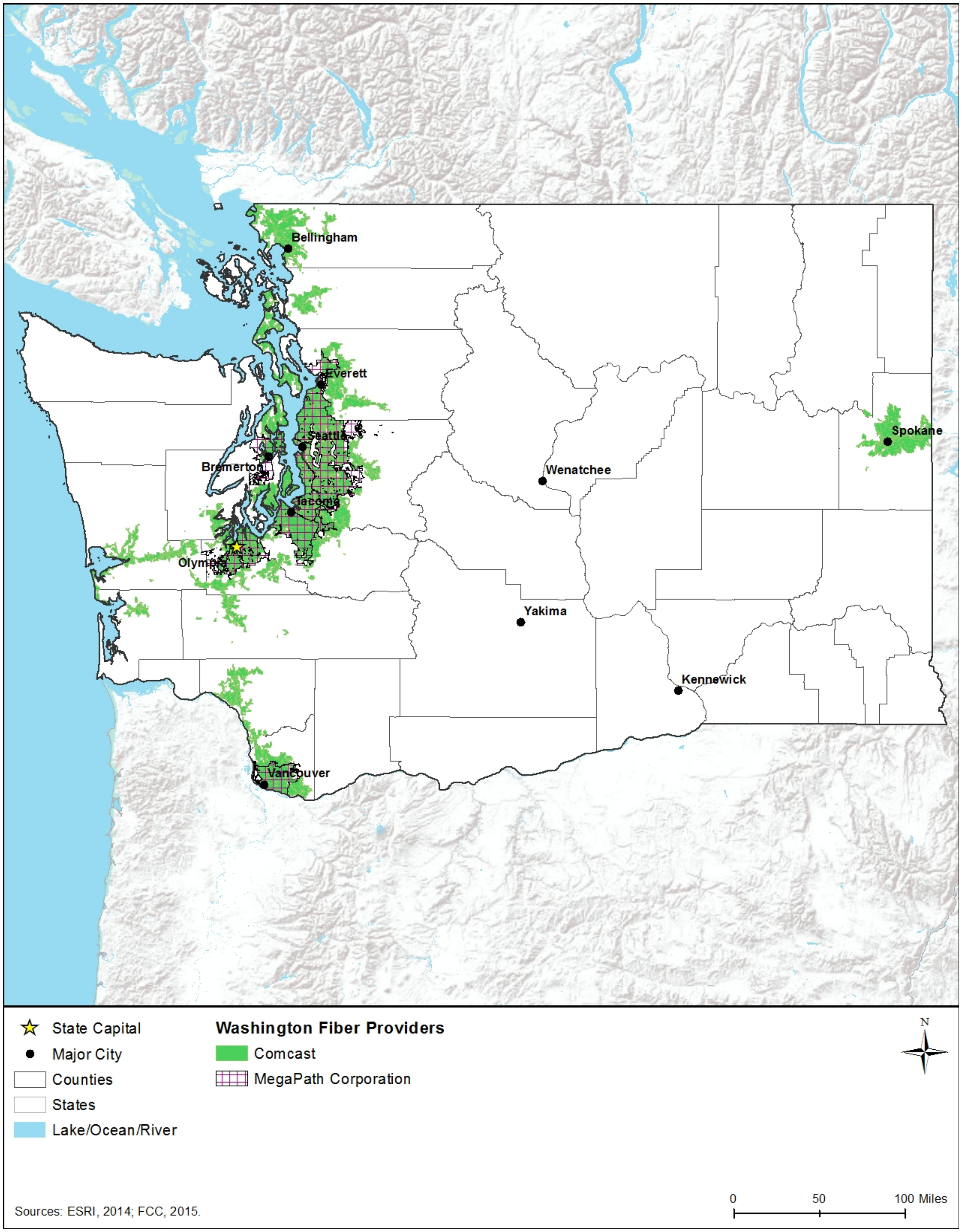

Figure 8.1.1-14: Comcast and MegaPath Corporation's Fiber Availability in Washington

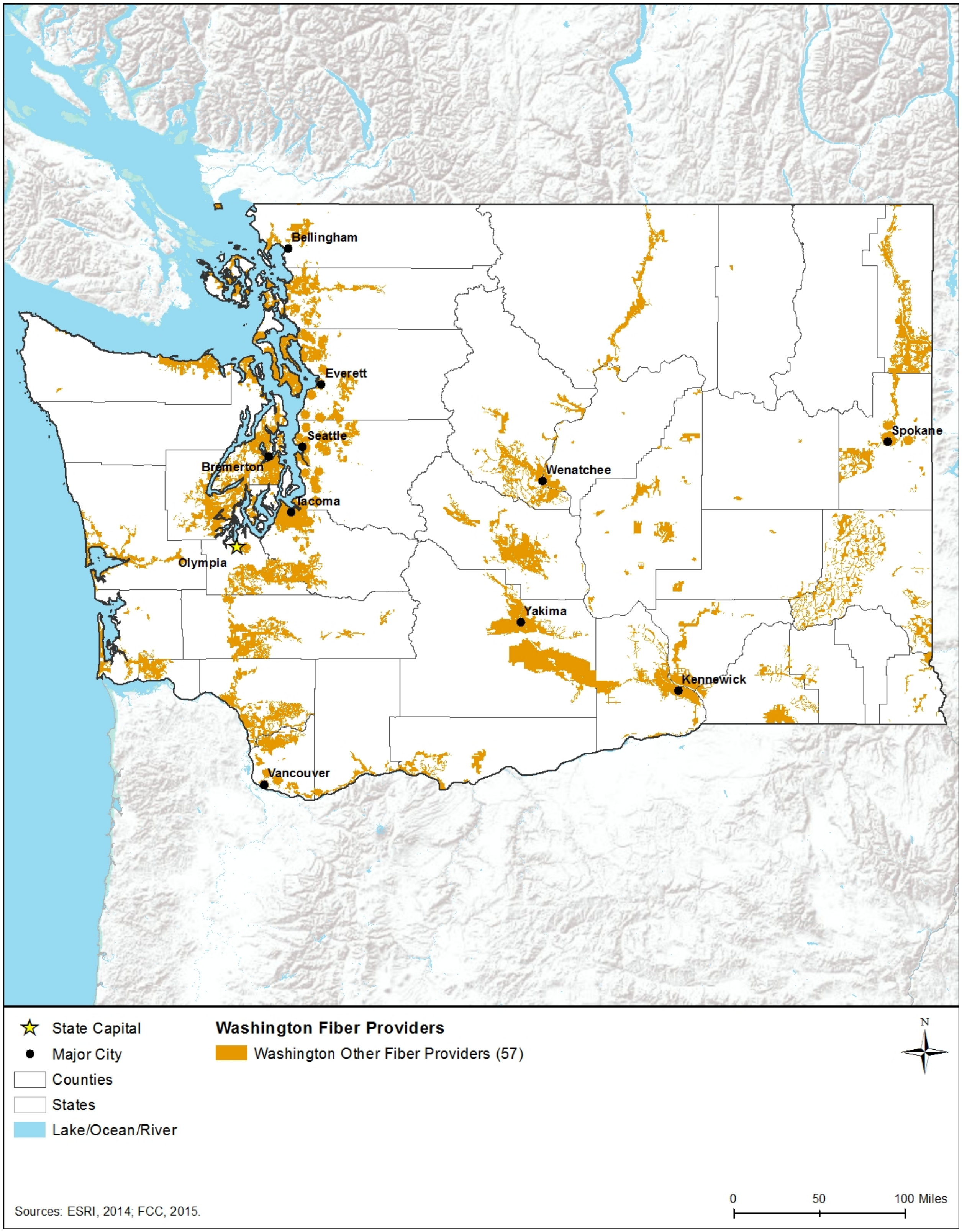

Figure 8.1.1-15: Other Provider's Fiber Availability in Washington

Data Centers

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

8.1.1.6. Utilities

Utilities are the essential systems that support daily operations in a community and cover a broad array of public services, such as electricity, water, wastewater, and solid waste. Section 8.1.4, Water Resources, describes the potable water sources in the state.

Electricity

Investor owned private electricity utilities in the state of Washington have their rate structure and quality of service regulated by the Washington Utilities and Transportation Commission (UTC, 2015a). The regulated electric utilities in the state are comprised of Avista Corporation, PacifiCorp, and Puget Sound Energy (UTC, 2015b). Avista operates in eastern Washington, PacifiCorp operates in southern and central Washington, and Puget Sound Energy operates in the west, near the Puget Sound (UTC, 2015c). The majority of the electricity generated in the state of Washington comes from facilities using hydroelectric power as a source (EIA 2015a).. In 2014, 79,463,144 megawatthours[13] of electricity came from hydroelectric. This amounted to 68 percent of the total 116,334,363 megawatthours generated that year. "The Grand Coulee Dam on Washington's Columbia River is the largest hydroelectric power producer in the United States, with a net summer generating capacity of 7,079 megawatts" (EIA, 2015b). Natural gas accounted for 11,058,815 megawatthours (9 percent), nuclear facilities provided 9,497,321 8,161 megawatthours (8 percent), and wind facilities 7,267,794 megawatthours (6 percent) (EIA 2015a). "Washington ranked 10th in the nation in net generation of electricity from wind energy in 2014" (EIA, 2015b). Other sources included biomass and coal (EIA, 2015g). This energy is largely consumed by the transportation and industrial sectors, at 29.3 percent and 27.6 percent respectively consumed in 2013. The residential sector of Washington used 24.3 percent, while the commercial sector used just 18.8 percent (EIA, 2015b).

Water

The Washington State Department of Health (DOH) monitors and regulates the quality of the drinking water used by 5.5 million citizens of Washington, or 85 percent of the state's population

[13] One Megawatthour is defined as "One thousand kilowatthours or 1 million watthours." One Watthour can be defined as "The electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour." (EIA, 2016)

(DOH, 2015a). The regulation of the DOH covers public water systems, which are "any system, providing water for human consumption through pipes or other constructed conveyances" (Washington State Legislature, 2015f). These are broken into three categories: community, non-transient non-community, and transient non-community. Community systems have fifteen or more service connections and are used by long-term residents; either for an unspecified number of people for 180 days or 25 people year round. Non-transient non-community systems serve 25 or more of the same people 180 days a year. While transient non-community systems serve different people, or at least 25 of the same people more than 60 days a year, but less than 180 (Washington State Legislature, 2015f). Operation of all of the systems listed here, as all of these categories are included in Group A, requires a permit renewal each year (DOH, 2015b). "The 1996 Safe Drinking Water Act Amendments required all states to establish and implement a Source Water Assessment Program" (DOH, 2015c). In Washington, the Source Water Protection Program facilitates this. A Source Water Assessment requires that an area used as a source for drinking water be outlined and potential contaminants be identified. It also requires public water systems to determine the level of risk associated with any potential contaminants. (DOH, 2015c) Much of this information is also used in Consumer Confidence Reports (CCRs). The DOH requires each community water system to send a document to their customers annually, outlining the sources of the drinking water (such as groundwater or surface water), contaminants found in the water, and an explanation of any problems they may cause, likely sources of water contamination and any violation of regulations set forth by DOH or the federal Clean Water Act (DOH, 2015d).

Wastewater

The treatment, discharge, and general management of Washington's wastewater is the responsibility of Washington's Department of Ecology (Washington DOE). "The state of Washington, Department of Ecology, Water Quality Program, is delegated by the U.S. Environmental Protection Agency (USEPA) as the state water pollution control agency, responsible for implementing all federal and state water pollution control laws and regulations" (Washington Department of Ecology, 2015a). "State permits are required for anyone who discharges waste materials from a commercial, industrial, or municipal operation to ground or to a publicly owned treatment plant. National Pollutant Discharge Elimination System (NPDES) permits are required for anyone who discharges to, or has a significant potential to impact, surface waters" (Washington Department of Ecology, 2015b). Washington DOE has the authority to operate NPDES on a state level. General permits authorize discharge a number of similar facilities, usually in an industry. Examples of general wastewater permits include permits for "concentrated animal feeding operations" and "water treatment plants" (Washington Department of Ecology, 2015c). Individual permits authorize a single facility with more specific needs, and as such are tailored to the facility itself (Washington Department of Ecology, 2015d). The operators of wastewater facilities must be certified by the state in order to protect public health and state resources. Washington DOE offers five levels of certification, which are differentiated by their requirements regarding education and wastewater experience. Higher levels also require a certain amount of time to have been spent at lower-classified wastewater facilities (Washington Department of Ecology, 2015e).

Solid Waste Management

Washington DOE is also responsible for the regulation and management of solid waste disposal facilities (Washington Department of Ecology, 2015f). Washington is home to 49 composting operations, 24 inert waste landfills, 15 limited purpose landfills, 660 recycling operations, 97 transfer stations, and 14 operation municipal landfills (Washington Department of Ecology, 2015g). These facilities have a combined remaining capacity of 412 million tons, which translates to roughly 62 years of use. In 2013, the state generated 16,951,501 tons of waste. Landfills would eventually accept 47 percent of this, while 20 percent went to municipal recycling facilities, and 20 percent was diverted elsewhere. Composting operations accounted for 8 percent of this, while combustion accomplished about 5 percent. Washington has experienced a decrease in its overall diversion rate since 2011, where the state had a record rate of 57 percent; by 2013, this had fallen to just 51 percent (Washington Department of Ecology, 2014a). Materials diverted from the waste stream are still poorly defined. Washington DOE tracks "materials reported as diverted from the waste stream, but outside the state's definition of municipal or traditional recycling." (Washington Department of Ecology, 2014a)

8.1.2. Soils

8.1.2.1. 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 do.

- *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.

8.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. Applicable federal laws and regulations that apply for soils, such as the Farmland Protection Policy Act of 1981, are in Appendix C, Environmental Laws and Regulations. A list of applicable state laws and regulations is included in Table 8.1.2-1 below.

Table 8.1.2-1: Relevant Washington Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
NPDES Construction Stormwater	Washington DOE	Sediment and erosion control measures are mandatory under the NPDES Construction permit, which is required for activities that disturb one or more acres of land and have potential stormwater or storm drain discharge to surface water.
The State Environmental Policy Act (SEPA)	State of Washington Department of Ecology	SEPA provides a process to identify possible environmental impacts that may result from governmental decisions related to issuing permits, constructing public facilities, or adopting regulations, policies, or plans.

8.1.2.3. Environmental Setting

Washington is composed of three Land Resource Region (LRR),[14] as defined by the Natural Resources Conservation Service (NRCS) (Natural Resources Conservation Service, 2006):

- Northwestern Forest, Forage, and Specialty Crop Region
- Northwestern Wheat and Range Region
- Rocky Mountain Range and Forest Region

Within and among Washington's three LRRs are 11 Major Land Resource Areas (MLRA),[15] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (Natural Resources Conservation Service, 2006). The locations and characteristics of Washington's MLRAs are presented in Figure 8.1.2-1 and Table 8.1.2-2.

Soil characteristics are an important consideration for FirstNet insomuch as soil properties could influence the suitability of sites for network deployment. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, elevation, and position on the landscape, biota[16] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic

[14] 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)
[15] 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)
[16] The flora and fauna of a region.

variables such as precipitation and temperature. For example, expansive soils[17] 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[18] (discussed further in the subsections below).

[17] Expansive soils are characterized by "the presence of swelling clay minerals" that absorb water molecules when wet and expand in size or shrink when dry leaving "voids in the soil." (Rogers, Olshansky, & Rogers, 2004)
[18] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).

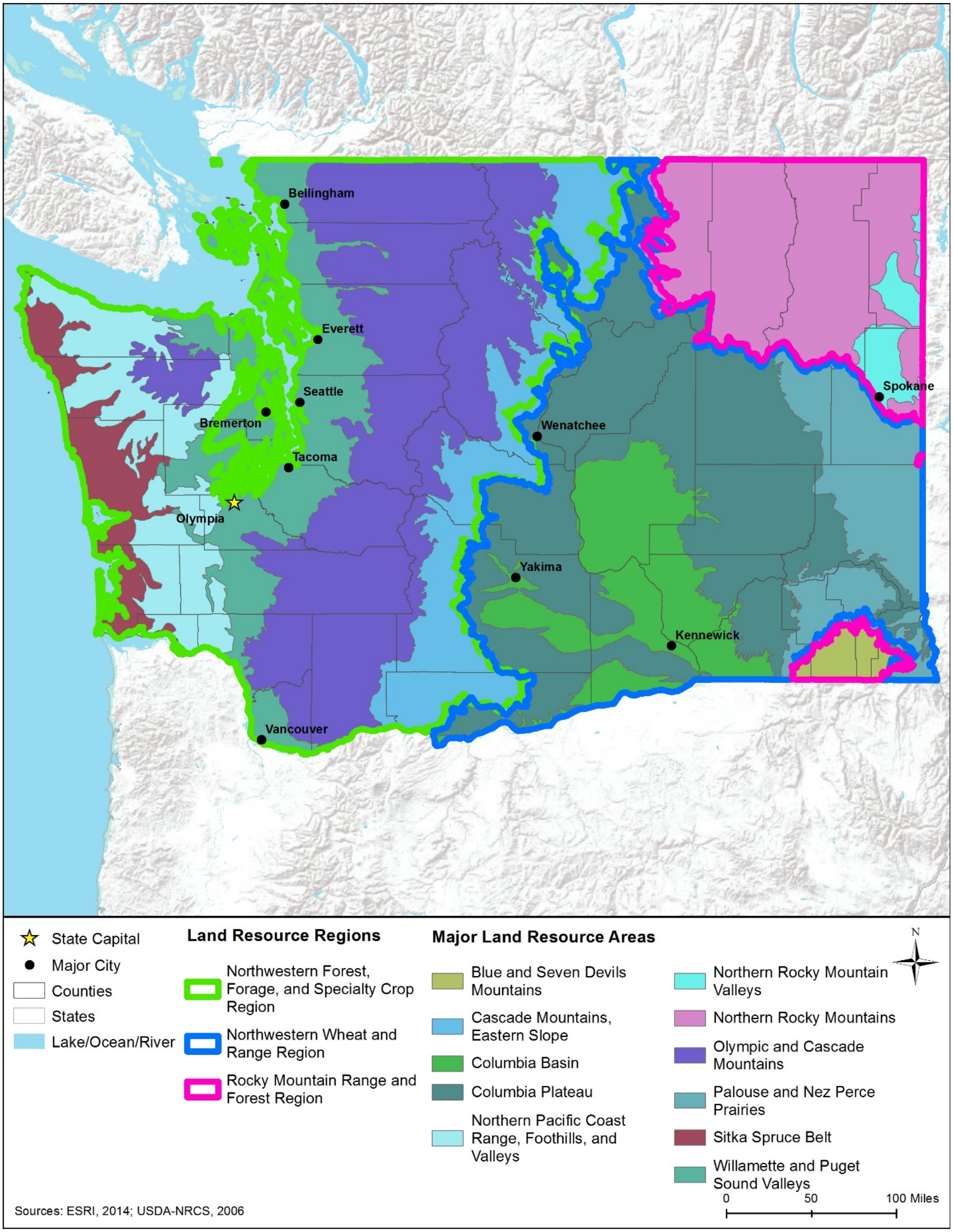

Figure 8.1.2-1: Locations of Major Land Resource Areas in Washington

Table 8.1.2-2: Characteristics of Major Land Resource Areas in Washington

MLRA Name	Region of State	Soil Characteristics
Blue and Seven Devils Mountains	Southeastern Washington	Andisols[a] and Mollisols[b] are the dominant soil orders. These soils of varying texture range from very poorly drained to well drained, and range from shallow to very deep.
Cascade Mountains, Eastern Slope	Central Washington	Alfisols,[c] Andisols, Inceptisols,[d] and Mollisols are the dominant soil orders. These well drained soils are ashy or loamy[e], and are moderately deep to very deep.
Columbia Basin	South-central Washington	Aridisols[f] and Entisols[g] are the dominant soil orders. These well drained to excessively drained soils are moderately deep to very deep, and are loamy.
Columbia Plateau	Central and Eastern Washington	Mollisols is the dominant soil order. These loamy and well drained soils are typically moderately deep to very deep.
Northern Pacific Coast Range, Foothills, and Valleys	Western Washington	Andisols, Inceptisols, and Ultisols[h] are the dominant soil orders. These well drained soils are clayey or loamy, and range from shallow to very deep.
Northern Rocky Mountain Valleys	Northeastern Washington	Andisols, Mollisols, and Inceptisols are the dominant soil orders. These well drained soils are typically very deep, and are loamy or loamy skeletal.
Northern Rocky Mountains	Northeastern Washington	Alfisols, Andisols, and Inceptisols are the dominant soil orders. These soils range from very poorly drained to well drained, and range from shallow to very deep.
Olympic and Cascade Mountains	Western Washington	Andisols, Inceptisols, Spodosols,[i] and Ultisols are the dominant soil orders. These well drained soils are typically moderately deep to very deep, and are clayey or loamy and ashy.
Palouse and Nez Perce Prairies	Southeastern Washington	Mollisols is the dominant soil order. These loamy soils are moderately well drained to well drained, and are typically deep or very deep.
Sitka Spruce Belt	Western Washington	Andisols, Entisols, Inceptisols, and Spodosols are the dominant soil orders. These soils range from poorly drained to well drained, and range from shallow to very deep.
Willamette and Puget Sound Valleys	Western Washington	Alfisols, Inceptisols, Mollisols, and Ultisols, are the dominant soil orders. These soils range from poorly drained to well drained, are moderately deep to very deep, and are clayey or loamy.

[a] Andisols: "Highly productive soils. They are common in cool areas with moderate to high precipitation, especially those areas associated with volcanic materials." (Natural Resources Conservation Service, 2015b)
[b] Mollisols: "Soils that have a dark colored surface horizon relatively high in content of organic matter. They are base rich throughout and quite fertile. Mollisols form under grass in climates that have a moderate to pronounced seasonal moisture deficit." (Natural Resources Conservation Service, 2015b)
[c] Alfisols: "Soils found in semiarid to moist areas that are formed from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil. They are productive for most crop, are primarily formed under forest or mixed vegetative cover, and make up nearly 10 percent of the world's ice-free land surface." (Natural Resources Conservation Service, 2015b)
[d] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates, and make up nearly 17 percent of the world's ice-free land surface." (Natural Resources Conservation Service, 2015b)
[e] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts." (Purdue University Consumer Horticulture, 2006)

[f] Aridisols: "Soils that are too dry for the growth of mesophytic plants. Lack of moisture greatly restricts the intensity of the weathering process and limits most soil development processes to the upper part of the soils. They make up about 12 percent of the world's ice-free land surface." (Natural Resources Conservation Service, 2015b)
[g] Entisols: "Soils that show little to no pedogenic horizon development. They occur in areas of recently deposited parent materials or in dunes, steep slopes, or flood plains where erosion or deposition rates are faster than rate of soil development. They make up nearly 16 percent of the world's ice-free land surface." (Natural Resources Conservation Service, 2015b)
[h] Ultisols: "Soils found in humid environments that are formed from fairly intense weathering and leaching processes. This results in a clay-enriched subsoil dominated by minerals. They have nutrients concentrated in the upper few inches and make up 8 percent of the world's ice-free land surface." (Natural Resources Conservation Service, 2015b)
[i] Spodosols: "Spodosols formed from weathering processes that strip organic matter combined with aluminum from the surface layer and deposit them in the subsoil. They commonly occur in areas of course-textured deposits under coniferous forests of humid regions, tend to be acid and infertile, and make up about 4 percent of the world's ice-free land surface." (Natural Resources Conservation Service, 2015b)
Source: (Natural Resources Conservation Service, 2006)

8.1.2.4. Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy[19]; there are 12 soil orders in the world and they are characterized by both observed and inferred[20] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (Natural Resources Conservation Service, 2015c). The STATSGO2[21] soil database identifies 29 different soil suborders in Washington (Natural Resources Conservation Service, 2015d). Figure 8.1.2-2 depicts the distribution of the soil suborders, and Table 8.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[19] "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2013a).
[20] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)." (Natural Resources Conservation Service, 2015c)
[21] STATSGO2 is the Digital General Soil Map of the United States that shows general soil association units across the landscape of the nation. Developed by the National Cooperative Soil Survey, STATSGO2 supersedes the State Soil Geographic (STATSGO) dataset.

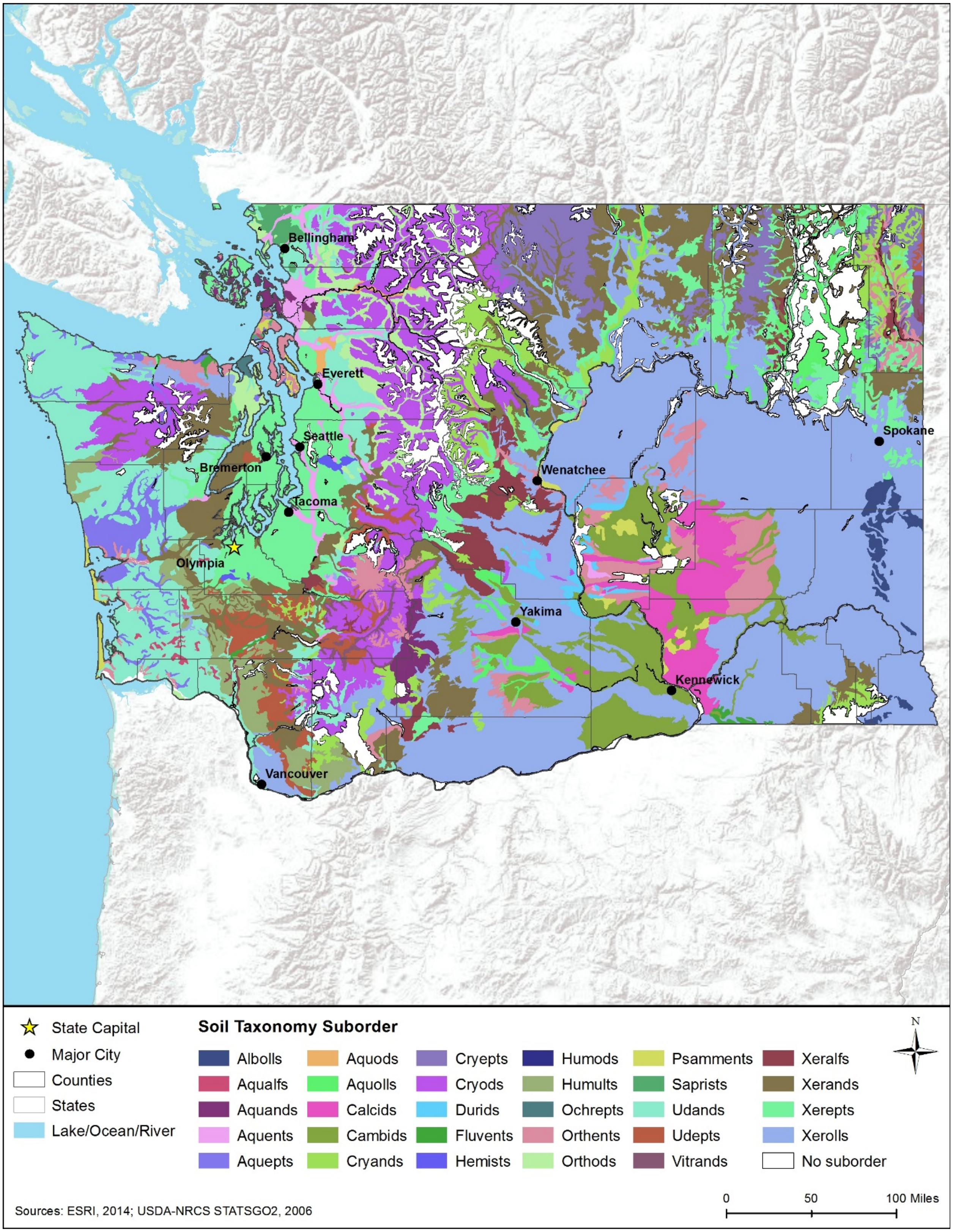

Figure 8.1.2-2: Washington Soil Taxonomy Suborders

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Table 8.1.2-3: Major Characteristics of Soil Suborders[a] Found in Washington, as depicted in Figure 8.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[c]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
Mollisols	Albolls	Albolls have a fluctuating groundwater table, with gentle slopes. They supported grasses and shrubs, and are typically used as cropland.	Silt loam, Silty clay	3-40	Moderately well drained	No	C	Medium	Low	Medium	Low
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Aqualfs are used as cropland for growing corn, soybeans, and rice and most have some artificial drainage or other water control. Nearly all Aqualfs have likely supported forest vegetation in the past.	Fine sandy loam, Silt loam	0-30	Poorly drained to somewhat poorly drained	No, Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Andisols	Aquands	Aquands are primarily found under grass or forest vegetation, and are used as pasture or cropland.	Loam, Loamy sand, Silt loam	0-8	Poorly drained to somewhat poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Entisols	Aquents	Widely distributed, with some forming in sandy deposits, and most forming in recent sediments. Aquents support vegetation that tolerates either permanent or periodic wetness, and are mostly used for pasture, cropland, forest, or wildlife habitat.	Silt loam, Silty clay loam	0-3	Very poorly drained to poorly drained	No, Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage. If these soils have not been artificially drained, groundwater is at or near the soil surface at some time during normal years (although not usually in all seasons). They are used primarily for pasture, cropland, forest, or wildlife habitat. Many Aquepts have formed under forest vegetation, but they can have almost any kind of vegetation.	Cemented, Clay, Silt loam, Silty clay, Silty clay loam	0-8	Very poorly drained to somewhat poorly drained	No, Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Spodosols	Aquods	Aquods are characterized by a shallow fluctuating water table, with water-loving vegetation, ranging from moss, shrubs, and trees in cold areas to mixed forests and palms in the warmest areas. Although some Aquods have been cleared and are used as cropland or pasture, most are used as forest or wildlife habitat, as they are naturally infertile (but they can be highly responsive to good management).	Fine sandy loam	0-2	Poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Mollisols	Aquolls	Aquolls support grass, sedge, and forb vegetation, as well as some forest vegetation. However, most have been artificially drained and utilized as cropland.	Clay loam, Silt loam, Silty clay loam, Stratified gravelly sand to fine sandy loam	0-3	Poorly drained to somewhat poorly drained	No, Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Aridisols	Calcids	Calcids are found in the western United States, and used primarily as wildlife habitat or rangeland, although some have been utilized as irrigated cropland. They have high levels calcium carbonates that persist due to insufficient precipitation.	Very fine sandy loam	0-10	Well drained	No	B	Medium	Moderate	Medium	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[c]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
Aridisols	Cambids	Cambids are found in the western United States, with little soil development. They are primarily used as wildlife habitat or rangeland, although some can also be used as cropland, if irrigated.	Clay loam, Extremely gravelly loamy sand, Fine sandy loam, Gravelly loam, Silt loam, Unweathered bedrock, Very fine sandy loam	0-40	Moderately well drained to somewhat excessively drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Andisols	Cryands	Cryands are typically used as forest, and are primarily formed under vegetation in coniferous forests.	Gravelly fine sandy loam, Loam, Silt loam, Unweathered bedrock, Very gravelly loam, Very gravelly sandy loam	0-80	Well drained	No	A, B, C	Low, Medium	High, Moderate, Low	Low to Medium, depending on slope	Low
Inceptisols	Cryepts	Cryepts are soils of high latitudes or high elevations, and support cold weather vegetation such as conifers and hardwoods. They are mostly used as forest or wildlife habitat, although some are also used as cropland.	Extremely stony sandy loam, Loam, Very cobbly sandy loam, Very gravelly sandy loam, Very stony sandy loam	30-90	Moderately well drained to well drained	No	B, C	Medium	Moderate, Low	Medium	Low
Spodosols	Cryods	Cryods are soils of high latitudes and/or high elevations, with coniferous forest vegetation, and are used as forest or wildlife habitat.	Cemented, Fine sandy loam, Gravelly loam, Loam, Sandy loam, Very gravelly sandy loam, Very gravelly silt loam	3-90	Moderately well drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Aridisols	Durids	Durids are found in the western United States, with the majority found in Nevada and Idaho. A few areas are used as irrigated cropland, but most are utilized as wildlife habitat or rangeland. They are characterized by a soil subsurface horizon cemented by silica (duripan).	Indurated, Silt loam	5-15	Well drained	No	D	High	Very Low	High	Low
Entisols	Fluvents	Fluvents are mostly freely drained soils that form in recently deposited sediments on flood plains, fans, and deltas located along rivers and small streams. Unless protected by dams or levees, these soils frequently flood. Fluvents are normally utilized as rangeland, forest, pasture, or wildlife habitat, with some also used for cropland.	Gravelly fine sandy loam, Sand, Stratified fine sandy loam to silty clay loam	0-5	Well drained to somewhat excessively 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.	Muck	0-1	Very poorly drained	Yes	D	High	Very Low	High	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 sandy loam	30-60	Well drained	No	C	Medium	Low	Medium	Low
Ultisols	Humults	Humults are generally freely drained and support both coniferous forest and rain forest. They are primarily used as pasture, forest, or cropland.	Clay loam, Gravelly clay loam, Silt loam, Silty clay loam	20-65	Well drained	No	B	Medium	Moderate	Medium	Low
Inceptisols	Ochrepts	The Ochrepts suborder has been removed from the Soil Taxonomy; most of these soils were moved to the Udept suborder.[c]	Cemented	15-30	Moderately well drained	No	C	Medium	Low	Medium	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[c]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Gravelly fine sandy loam, Gravelly loam, Gravelly loamy sand, Gravelly sandy loam, Loamy fine sand, Sandy loam, Silt loam, Very cobbly loam, Very cobbly loamy sand, Very gravelly fine sand, Very gravelly loamy sand	0-70	Moderately well drained to excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	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.	Gravelly sandy loam, Loam, Silt loam, Very channery loam, Weathered bedrock	0-60	Moderately well drained to well drained	No	C	Medium	Low	Medium	Low
Entisols	Psamments	Psamments are sandy in all layers. In some arid and semi-arid climates, they are among the most productive rangeland soils, and are primarily used as rangeland, pasture, or wildlife habitat. Those Psamments that are nearly bare are subject to wind erosion and drifting, and do provide good support for wheeled vehicles.	Fine sand, Gravelly sand, Loamy fine sand, Loamy sand	0-30	Excessively drained	No	A	Low	High	Low	Low
Histosols	Saprists	Saprists have organic materials are well decomposed, and many support natural vegetation and are used as woodland, rangeland, or wildlife habitat. Some Saprists, particularly those with a mesic or warmer temperature regime, have been cleared, drained, and used as cropland.	Muck	0-2	Very poorly drained to poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Andisols	Udands	Udands form primarily under forest vegetation, and are used as cropland, pasture, or forest.	Gravelly fine sandy loam, Gravelly loam, Gravelly silt loam, Loam, Silt loam, Silty clay loam, Very cobbly loam, Very gravelly loam, Very gravelly sand	0-70	Moderately well drained to well drained	No	B, C	Medium	Moderate, 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.	Clay loam, Silt loam, Unweathered bedrock, Very gravelly loam, Very gravelly sandy loam, Very gravelly silty clay loam	0-65	Well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Andisols	Vitrands	Vitrands are mostly utilized as forest, although some can be used for rangeland, or cleared and used for pasture or cropland. They are generally well drained, with a coarse texture and low water content. These soils typically form under coniferous forest vegetation.	Extremely cobbly loam, Extremely cobbly sandy loam, Gravelly sandy loam, Silt loam, Very gravelly sand	0-75	Well drained	No	B	Medium	Moderate	Medium	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[c]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
Alfisols	Xeralfs	Xeralfs support warmer weather, drier vegetation such as annual grasses, forbs, and woody shrubs, along with cooler, wetter vegetation such as coniferous forest. They are typically used for forest, grazing, and croplands.	Clay loam, Extremely gravelly loam, Gravelly clay loam, Silt loam, Unweathered bedrock	0-65	Moderately well drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Andisols	Xerands	Xerands are used as forest, pasture, or cropland. They form under grass and shrub vegetation or under coniferous forest vegetation.	Coarse sand, Extremely gravelly sandy loam, Extremely stony sand, Gravelly fine sandy loam, Gravelly loam, Gravelly silt loam, Loam, Sandy loam, Silt loam, Very gravelly coarse sandy loam, Very gravelly sand, Very gravelly sandy loam, Very stony loam	0-90	Moderately well drained to somewhat excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Inceptisols	Xerepts	Xerepts support coniferous forest, shrubs, grasses, and trees, are typically used for forest, pasture, or croplands, and sometimes as wildlife habitat or rangeland. They are generally freely drained and found in the western United States.	Cemented, Clay loam, Extremely gravelly coarse sand, Extremely gravelly loamy sand, Fine sandy loam, Gravelly coarse sandy loam, Gravelly loam, Gravelly loamy coarse sand, Gravelly loamy sand, Gravelly sandy loam, Loam, Sand, Sandy loam, Silt loam, Stratified silt to silty clay loam, Very gravelly coarse sand, Very gravelly loam, Very gravelly sand, Very gravelly silt loam	0-90	Moderately well drained to somewhat excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[c]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
Mollisols	Xerolls	Xerolls are found on sloping lands that Mediterranean climates. They are generally freely drained, although typically dry for extended periods in summer. These soils are used for irrigated croplands, and those on very steep slopes are used for rangeland and forest.	Cemented, Clay loam, Coarse sand, Cobbly fine sandy loam, Cobbly loam, Cobbly silt loam, Extremely channery loam, Extremely cobbly loam, Extremely flaggy loam, Extremely gravelly sandy clay loam, Fine sandy loam, Gravelly clay, Gravelly clay loam, Gravelly loam, Gravelly sand, Gravelly sandy loam, Gravelly silt loam, Gravelly silty clay loam, Loam, Loamy fine sand, Loamy sand, Sand, Sandy loam, Silt loam, Silty clay, Silty clay loam, Stratified very fine sandy loam to silty clay loam, Unweathered bedrock, Very cobbly loam, Very cobbly silty clay loam, Very fine sandy loam, Very gravelly clay loam, Very gravelly coarse sand, Very gravelly loam, Very gravelly loamy sand, Very gravelly sandy clay loam, Very gravelly sandy loam	0-90	Poorly drained to excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low

[a] Soil suborders constitute a broad range of soil types. Within each suborder, the range of soil types may have a range of properties across the state, which result in multiple values being displayed in the table for that suborder.
[b] Hydric Soil: "A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (Natural Resources Conservation Service, 2015e). Soil suborders constitute a broad range of soil types. Within each soil suborder, some specific soil types are hydric while others are not.
[c] Based on Runoff Potential, described in Section 8.1.2.5

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

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8.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[22] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 8.1.2-3 provides a summary of the runoff potential for each soil suborder in Washington.

Group A. Sand, loamy sand or sandy loam soils. This group of soils has "low runoff potential and high infiltration rates[23] even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission" (Purdue University, 2015). Cryands, Orthents, Psamments, Xerands, Xerepts, and Xerolls fall into this category in Washington.

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. Calcids, Cambids, Cryands, Cryepts, Cryods, Fluvents, Humults, Orthents, Udands, Udepts, Vitrands, Xeralfs, Xerands, Xerepts, and Xerolls fall into this category in Washington.

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. Albolls, Aquents, Aquepts, Aquolls, Cambids, Cryands, Cryepts, Cryods, Humods, Ochrepts, Orthents, Orthods, Udands, Udepts, Xeralfs, Xerands, Xerepts, and Xerolls fall into this category in Washington.

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, Aquands, Aquents, Aquepts, Aquods, Aquolls, Cambids, Cryods, Durids, Hemists, Orthents, Saprists, Udepts, Xeralfs, Xerands, Xerepts, and Xerolls fall into this category in Washington.

8.1.2.6. 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, 2015f). Water-

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

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 8.1.2-3 provides a summary of the erosion potential for each soil suborder in Washington. Soils with medium to high erosion potential in Washington include those in the Albolls, Aqualfs, Aquands, Aquents, Aquepts, Aquods, Aquolls, Calcids, Cambids, Cryands, Cryepts, Cryods, Durids, Fluvents, Hemists, Humods, Humults, Ochrepts, Orthents, Orthods, Saprists, Udands, Udepts, Vitrands, Xeralfs, Xerands, Xerepts, and Xerolls suborders, which are found throughout most of the state (Figure 8.1.2-2).

8.1.2.7. 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 (USFS, 2009b). Other characteristics that factor into compaction and rutting risk include soil composition (i.e. low organic soil is at increased risk of compaction), amount of pressure exerted on the soil, and repeatability (i.e., the number of times the pressure is exerted on the soil). Machinery and vehicles that have axle loads greater than ten tons can cause soil compaction of greater than 12 inches depth (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 8.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Washington. Soils with the highest potential for compaction and rutting in Washington include those in the Aqualfs, Aquands, Aquents, Aquepts, Aquods, Aquolls, Hemists, and Saprists suborders, which are found throughout the state (Figure 8.1.2-2).

8.1.3. Geology

8.1.3.1. 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 8.1.4), Human Health and Safety (Section 8.1.15), and Climate Change (Section 8.1.14).

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

- Section 8.1.3.3, Environmental Setting: Physiographic Regions and Provinces[24, 25]
- Section 8.1.3.4, Surface Geology
- Section 8.1.3.5, Bedrock Geology[26]
- Section 8.1.3.6, Paleontological Resources[27]
- Section 8.1.3.7, Fossil Fuel and Mineral Resources
- Section 8.1.3.8, Geologic Hazards[28]

8.1.3.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. A list of applicable state laws and regulations is included in Table 8.1.3-1.

Table 8.1.3-1: Relevant Washington Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
State Building Code Revised Code of Washington (RCW) 19.27.031	Washington State Legislature	Provides seismic guidelines for building construction.
Washington Administrative Code (WAC) 232-12-251	Washington Department of Fish and Wildlife	Fossils cannot be removed from Washington Department of Fish and Wildlife lands without a permit.

8.1.3.3. Environmental Setting: Physiographic Regions and Provinces

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

Washington has three major physiographic regions: Rocky Mountain System (Northern Rocky Mountains Province), Intermontane Plateau (Columbia Plateau Province), and Pacific Mountain System (Cascade-Sierra Mountains and Pacific Border Provinces) (USGS, 2003b). The

[24] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology (Fenneman, 1916).
[25] Physiographic provinces: Subsets within physiographic regions (Fenneman, 1916).
[26] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015a).
[27] Paleontology: "Study of life in past geologic time based on fossil plants and animals." (USGS, 2015b)
[28] Geologic Hazards: Any geological or hydrological process that poses a threat to people and/or their property, which includes but is not limited to volcanic eruptions, earthquakes, landslides, sinkholes, mudflows, flooding, and shoreline movements (NPS, 2013).

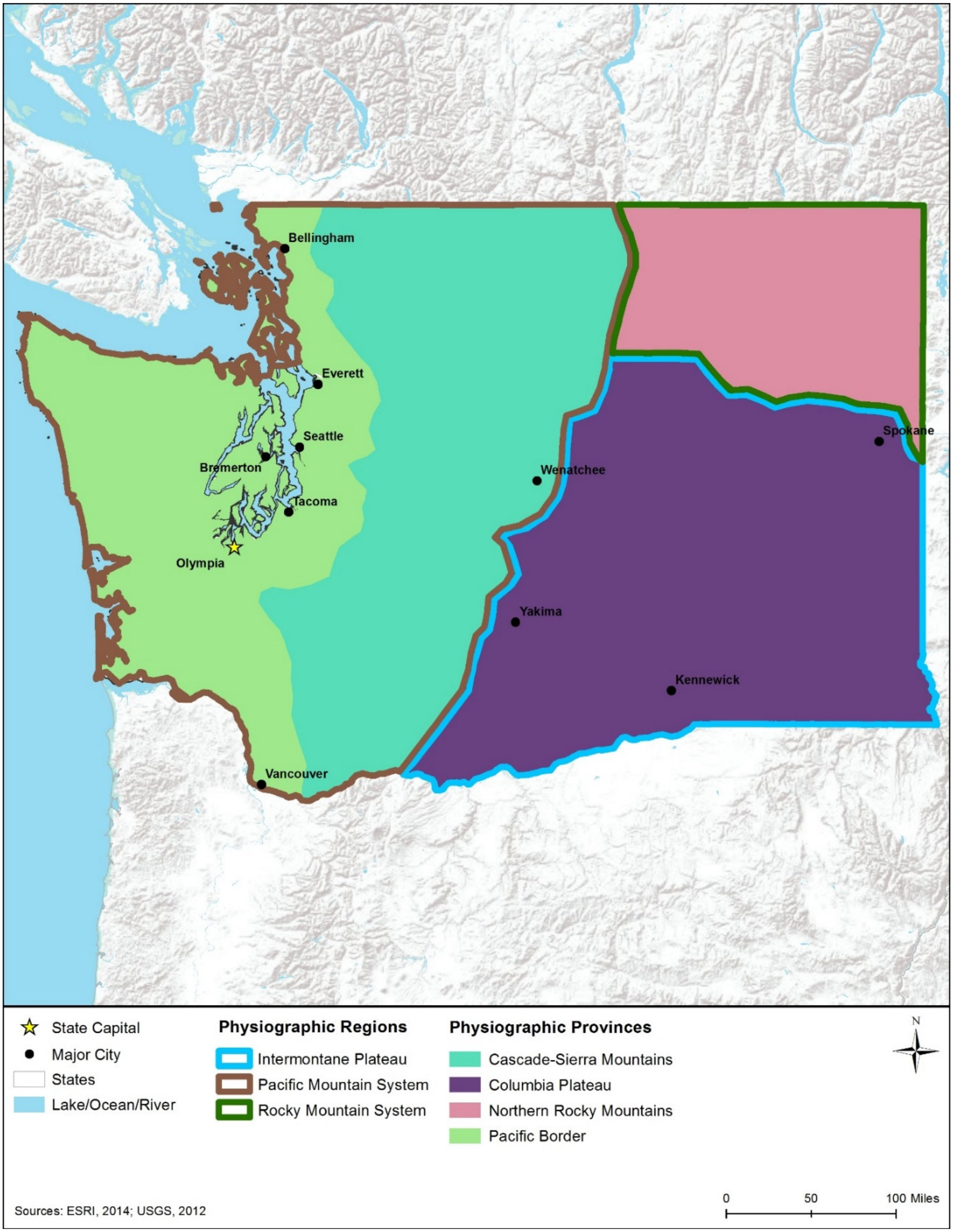

Figure 8.1.3-1: Physiographic Regions and Provinces of Washington

locations of these regions and provinces are shown in Figure 8.1.3-1 and their general characteristics summarized in the following subsections.

Rocky Mountain System

The Rocky Mountains form a line from the northern border with Canada south into central New Mexico. The Rocky Mountains were created during the Laramide orogeny,[29] which occurred between 70 and 40 million years ago (MYA).[30] They formed due to the collision of the Pacific Ocean oceanic crust[31] with the North American continental crust. In most cases, convergence of oceanic crust with continental crust results in mountain formation 200 to 400 miles from the coastline. However, the low angle of subduction by which the oceanic crust passed under the less dense continental crust during the Laramide orogeny, resulted in formation of the Rocky Mountains several hundred miles further inland than is normally observed (USGS, 2014a).

Northern Rocky Mountains Province – The Northern Rocky Mountains Province includes the northeastern corner of Washington along the state's eastern border with Idaho and northern border with Canada. Locally referred to as the Okanogan Highlands, Washington's Northern Rocky Mountains "are characterized by rounded mountains (up to 8,000 feet [above sea level (ASL)]) and deep, narrow valleys." The Columbia River bisects the Province into eastern and western sections. The eastern part of the Province is underlain by Precambrian (older than 542 MYA) basement rocks that are topped with Paleozoic (542 to 251 MYA) marine sedimentary[32] rocks. "The western half of the province was formed by deposition of sediments and volcanic rocks offshore to the west of the continental margin. Early Tertiary [(66 to 2.6 MYA)] volcanic eruptions filled the western basins with volcanic debris, which was later covered by fluvial and lacustrine sediments" (Washington State Department of Natural Resources, 2013).

Intermontane Plateau Region

The Intermontane Plateau Region describes the area between the Rocky Mountains and the Sierra Nevada and Cascade Ranges. The Intermontane Plateau Region dates to 80 MYA and predates the younger Rocky Mountain System to the east, which was created roughly 60 MYA. Interspersed high-elevation plateaus, mountains, and low-lying basins characterize the region. The Columbia Plateau Province is one of the major elevated areas in this region (Lew A. , 2004a).

Columbia Plateau Province – The Columbia Plateau Province includes portions of central and southeastern Washington. "[The Province] is characterized by loess[33] hills and incised rivers

[29] Orogeny: "An episode of mountain building and/or intense rock deformation." (USGS, 2015c)
[30] For consistency, this PEIS uses the University of California Berkeley Geologic Time Scale for all of the FirstNet PEIS state documents. Time scales differ among universities and researchers; FirstNet utilized a consistent time scale throughout, which may differ slightly from other sources.
[31] Crust: "The rocky, relatively low density, outermost layer of the Earth." (USGS, 2015c)
[32] Sedimentary Rock: "Sedimentary rocks are formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding" (USGS, 2015c).
[33] Loess: "A wind-blown deposit of sediment made mostly of silt-sized grains." (USGS, 2015c)

overlying flows of the Miocene Columbia River Basalt[34] Group, which issued from vents and fissures in southeastern Washington about 17 to 6 [MYA] ago. These basalts cover 36 percent of the state and reach a maximum thickness of 16,000 feet" (Washington State Department of Natural Resources, 2013). In the eastern portion of the Province, the Palouse Hills are composed of loess deposits that were deposited during the last Ice Age (which ended 11,700 years ago) (Washington State Department of Natural Resources, 2015a).

Pacific Mountain System Region

The Pacific Mountain System Region describes the area including the Cascade and Sierra Nevada mountain ranges, the Coastal mountain ranges, the valleys in between these mountain ranges, and the Pacific Coast. Peaks in the Cascades and Sierra Nevada mountains rise to over 12,000 feet ASL, while peaks in the Coastal range's granitic mountains are over 6,000 feet ASL. The Pacific Coast is an area of tectonic activity[35] (Lew A., 2004b).

Cascade-Sierra Mountains Province – The Cascade-Sierra Mountains Province is located in west-central Washington, running north and south along the Cascade mountain range. This province parallels the Pacific Ocean coastline in an arc shape, and is one of the most tectonically active, and youngest, province in the nation. It is characterized by a mountainous landscape, and includes thousands of short-lived volcanoes that have built up layers of lava and debris, as well as thirteen major volcanic centers (NPS, 2014a). "The Cascade Range consists of an active volcanic arc superimposed upon bedrock of Paleozoic to Tertiary age. Pliocene [(5.3 to 2.6 MYA)] to recent uplift has created high topographic relief." Mount Saint Helens, Mount Rainier, and Mount Baker are all active volcanoes within the Cascades that are less than 1 million years old (Washington State Department of Natural Resources, 2013). At 14,411 feet ASL, Mount Rainier is the highest point in Washington (USGS, 2001).

Pacific Border Province – The Pacific Border Province is located along the Pacific coastline of Washington, and includes the lands west of the Cascade Mountains. It is very tectonically active, and one of the youngest geological areas on the North American continent. The Pacific Border Province is characterized by lowlands and mountains on the eastern margin, and coastal areas to the west (NPS, 2014a). The Olympic Mountains (which nearly exceed 8,000 feet ASL at Mount Olympus) include much of northwestern Washington on the Olympic Peninsula. "The oldest bedrock of the Olympic Mountains is the lower Tertiary Crescent Formation, a thick sequence of submarine and subaerial basalt flows with some interbedded siltstone[36] and limestone[37]… Alpine glaciation carved the rugged peaks of the Olympic Range and flooded much of the coastal lowland with meltwater carrying sand and gravel." Further to the south, "the Willapa Hills are part of the Coast Range and include the adjacent broad valleys that open up to

[34] Basalt: "A dark, fine-grained, extrusive (volcanic) igneous rock with a low silica content (40 percent to 50 percent), but rich in iron, magnesium, and calcium." (USGS, 2015c)
[35] Tectonic Activity: "A term used to describe regions that are strongly affected by movement of Earth's tectonic plates. Earthquakes and volcanoes are common features in these regions." (USGS, 2015c)
[36] Siltstone: "A sedimentary rock made mostly of silt-sized grains." (USGS, 2015c)
[37] Limestone: "A sedimentary rock made mostly of the mineral calcite (calcium carbonate). Limestone is usually formed from shells of once-living organisms or other organic processes, but may also form by inorganic precipitation." (USGS, 2015c)

the Pacific Ocean… This province is underlain by Tertiary sedimentary and volcanic rocks deposited in nearshore embayments and shallow seas surrounding basalt islands” (Washington State Department of Natural Resources, 2013).

8.1.3.4. 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).

Washington’s surficial deposits range from before the Tertiary (66 to 2.6 MYA) Period to the Holocene Epoch (11,700 years ago to present) in age. Deposits grain sizes also vary depending on the sediment source. Coarse-grained, younger deposits originated from glaciers or streams, while older fine-grained deposits emanated from volcanoes, lakes, or the wind (USGS, 1994a). The Vashon glacial episode was the most recent to occur in Washington between 18,000 and 10,000 years ago. To the west of the Cascade Range, ice advanced south through the Puget Sound to Olympia. When the glaciers retreated, they left behind sand, gravel, and clay deposits throughout the region. East of the Cascade Range, ice periodically advanced and retreated, damming rivers and creating lakes, including the Lake Missoula near present-day Spokane. These ice dams repeatedly broke, sending catastrophic floods through the Columbia Basin, leaving behind pebbles, cobbles, and boulders (Townsend & Figge, 2002). Figure 8.1.3-2 depicts the main surficial composition of Washington.

National Natural Landmarks (NNLs) are sites designated by the U.S. Secretary of the Interior that “contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education” (NPS, 2014d). These landmarks may be considered visual resources or visually sensitive. In Washington, 18 NNLs exist entirely or partially within the state (Table 8.1.8-5).

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[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” (USGS, 2013b).

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

[40] Subsidence: “Gradual settling or sudden sinking of the Earth’s surface owing to subsurface movement of earth materials” (USGS, 2000).

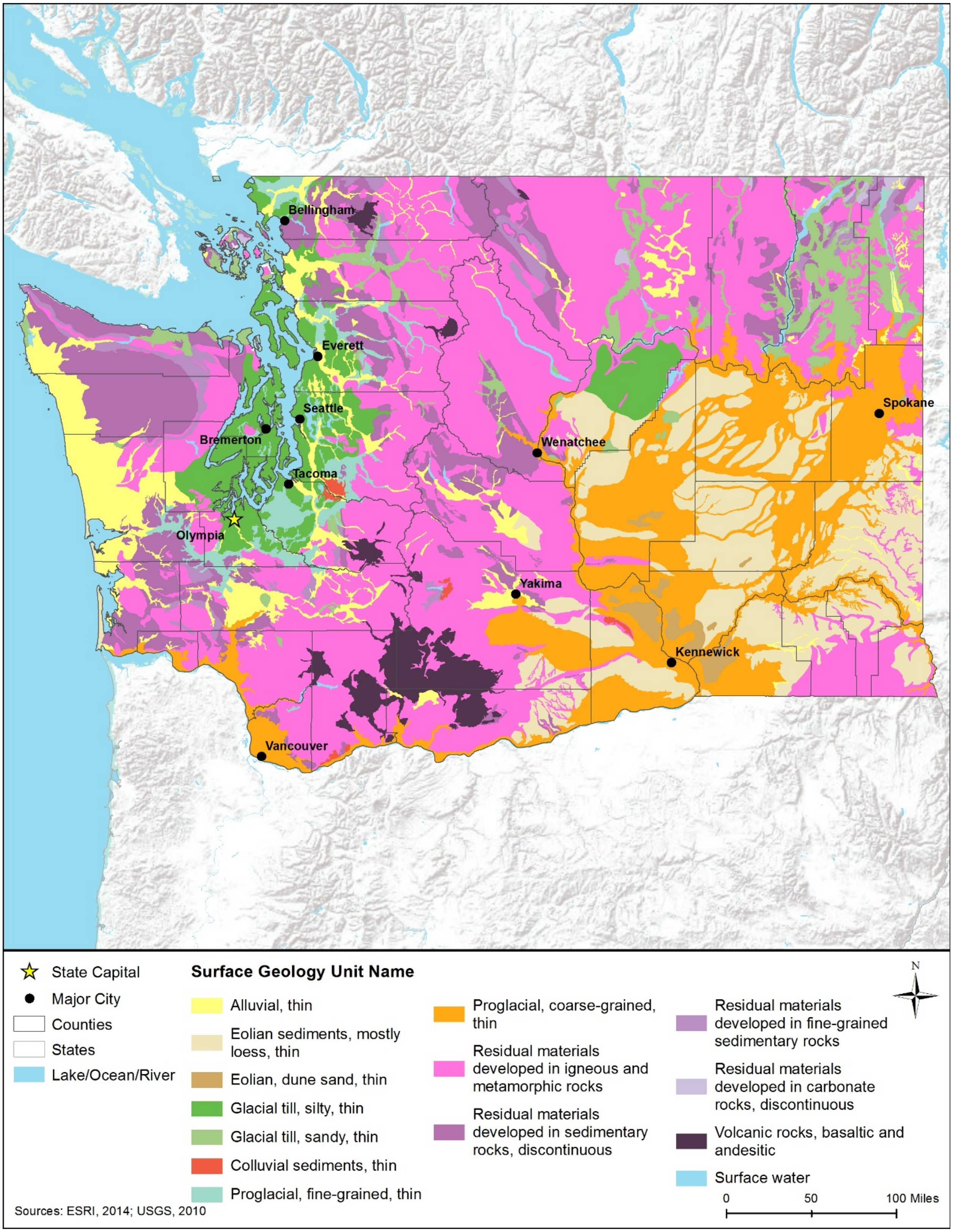


Figure 8.1.3-2: Generalized Surface Geology for Washington

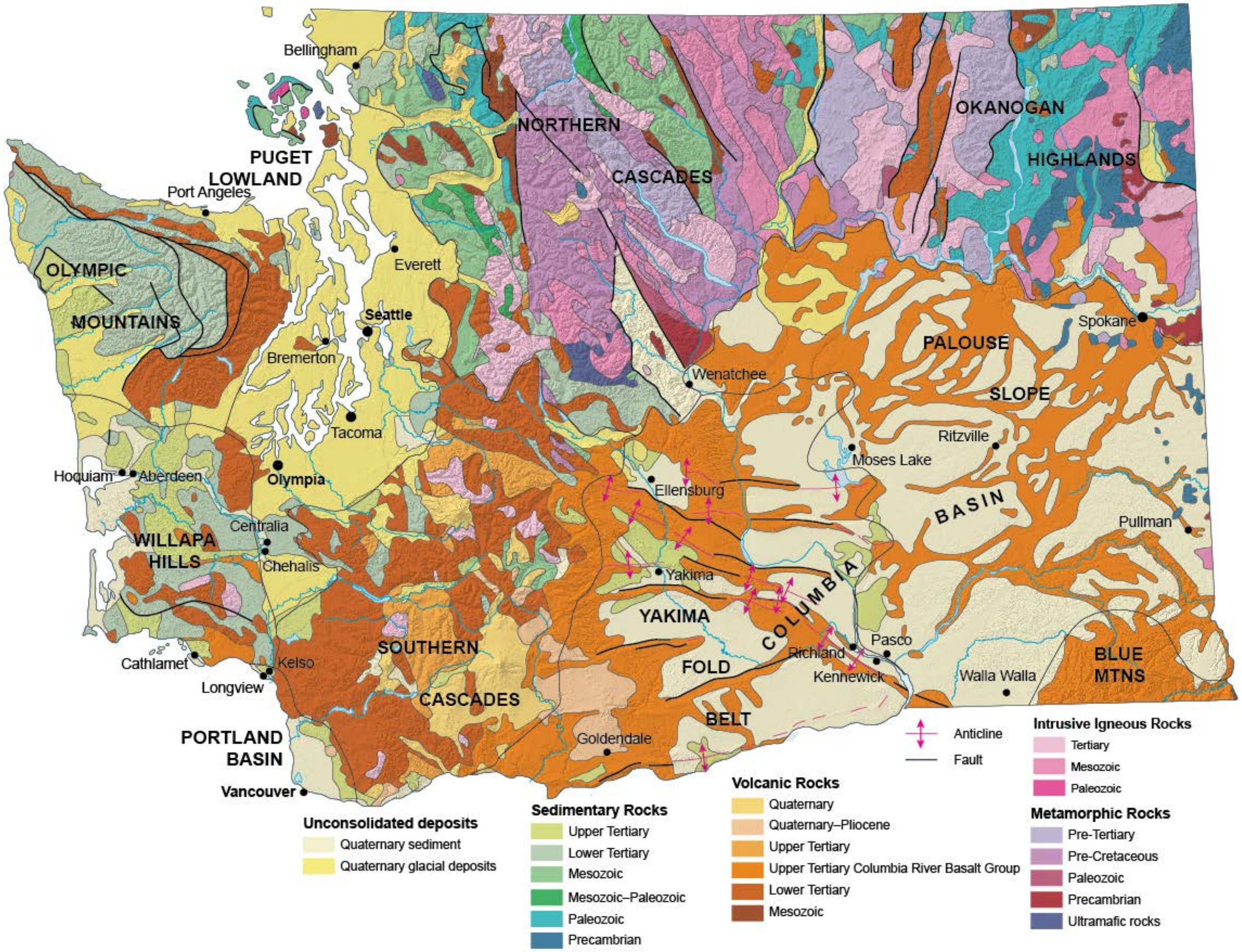
8.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015d) reveals important information about a region's surface and subsurface characteristics (i.e., three-dimensional geometry), including dip (slope of the formation),[41] rock composition, and regional tectonism.[42] These structural aspects of bedrock geology are often indicative of regional stability, as it relates to geologic hazards such as landslides, subsidence, earthquakes, and erosion (New Hampshire Department of Environmental Services, 2014).

Washington bedrock includes sedimentary and volcanic rock that is typically dense, with few fractures. Miocene (23 to 5.3 MYA) basaltic rock underlies most of eastern and south-central Washington, with some basaltic rocks in the Cascade Range dating to less than 2,000 years old. Undifferentiated volcanic rocks are also found in Washington, commonly in thick flows with a heterogeneous mixture of rocks. Undifferentiated consolidated sedimentary rock is found in the southwestern part of the state. These rocks are typically shale,[43] sandstone,[44] dolomite,[45] and limestone (USGS, 1994a).

Figure 8.1.3-3 displays the generalized bedrock geology for Washington.

[41] Dip: "A measure of the angle between the flat horizon and the slope of a sedimentary layer, fault plane, metamorphic foliation, or other geologic structure" (NPS, 2000).
[42] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust." (USGS, 2015e)
[43] 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." (USGS, 2015c)
[44] Sandstone: "Sedimentary rock made mostly of sand-sized grains." (USGS, 2015c)
[45] Dolomite: "A magnesium-rich carbonate sedimentary rock. Also, a magnesium-rich carbonate mineral ($CaMgCO_3$)." (USGS, 2015c)



Source: (Washington State Department of Natural Resources, 2015b)

Figure 8.1.3-3: Generalized Bedrock Geology for Washington

8.1.3.6. Paleontological Resources

Washington State Fossil -
Columbian Mammoth

Source: (University of California - Berkeley, 2015)

Cambrian (542 to 488 MYA) rocks in Washington include some of the world's oldest sponge fossils, along with brachiopods,[46] trilobites,[47] hyolithids,[48] and archaeocyaths.[49] Abundant Ordovician (488 to 44 MYA) marine fossils, such as conodonts[50] and graptolites,[51] are found in northeastern Washington. Marine and continental Devonian (416 to 359 MYA) Period sediments contain brachiopods, corals, crinoids,[52] foraminifera[53], and plant fossils. In the North Cascades, Carboniferous (359 to 299 MYA) and Permian (299 to 251 MYA) limestones and shales have yielded corals, brachiopods, clams, and snails (Paleontology Portal, 2015).

Washington's Mesozoic (251 to 66 MYA) fossils, including ammonites,[54] snails, and clam, are found in Jurassic (200 to 146 MYA) sedimentary rocks. Cretaceous (146 to 66 MYA) marine fossils, such as clams, snails, ammonites, and marine reptiles, have been located in the Cascade Range and western San Juan Islands (Paleontology Portal, 2015).

Fossils from the Cenozoic (66 MYA to present) Era are found in marine sediments east of the Cascades, and include whales, rare marine birds, clams, crabs, and snails. Fossils of flowers, leaves, and insects, have been recorded in sedimentary rocks that formed in coastal swamps (Paleontology Portal, 2015). Quaternary (2.6 MYA to present) fossils, including caribou, bison, and mammoth, indicate a cold climate in Washington (Livingston Jr., 1959). The Columbian

[46] Brachiopod: "Any member of a phylum of marine invertebrate animals called Brachiopoda. Brachiopods are sessile, bivalved organisms, but are more closely related to the colonial Bryozoa than the bivalved mollusks. Brachiopod diversity peaked in the Paleozoic, but some species survive." (Smithsonian Institution, 2016)

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

[48] Hyolithids: "An extinct small, shelled creature with a "long, flat-bottomed, conical shell" with "two curved appendages sticking out sideways, like props, at the front." (Smithsonian, 2016)

[49] Archaeocyaths: "Any member of an extinct order of sponges (Archaeocyatha) that are known only from the Lower to Middle Cambrian." (Smithsonian Institution, 2016)

[50] Conodont: "Any member of a group of worm-like, vertebrate organisms common from the Ordovician to the Triassic. Conodont dental batteries are important tools for Paleozoic and early Mesozoic biostratigraphy." (Smithsonian Institution, 2016)

[51] Graptolite: "Any member of the Graptolithina, a class of extinct marine invertebrate animals. Graptolites are believed to have been planktonic and are especially prevalent in Ordovician and Silurian rocks." (Smithsonian Institution, 2016)

[52] Crinoid: "The common name for any echinoderm of the class Crinoidea, including sea lilies, feather stars, etc. Crinoids are common fossils in the Paleozoic and persist to the present. Many species have stalks and radiating arms and feed on particles in the water column." Echinoderm: "The common name for members of the phylum Echinodermata. These organisms are characterized by bodies showing radial symmetry (usually in fives) and the presence of tube feet in most forms." (Smithsonian Institution, 2016)

[53] Foraminifera: "Any member of the order Foraminifera. Foraminifera, or forams, are single-celled organisms with calcareous shells that can be found in every marine habitat." (Smithsonian Institution, 2016)

[54] Ammonites: "Any member of an extinct suborder of cephalopod mollusks (Ammonoidea) with chambered, spiral shells that thrived in the Mesozoic and Paleozoic oceans." (Smithsonian Institution, 2016)

Mammoth lived during the Pleistocene (2.6 MYA to 11,700 years ago) Epoch, and is the state fossil of Washington (Washington State Legislature, 2015a).

8.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

Washington has not produced oil since the early 1960s and does not produce natural gas. However, although this is the case, Washington is one of the country's leaders in oil and gas refining.(EIA, 2015f)

Minerals

As of 2015, Washington's total nonfuel mineral production was valued at $936M. This level of production ranked 27th nationwide (in terms of dollar value) and accounted for approximately 1.2 percent of the total nationwide production value. In 2015, Washington's minerals were primarily sand and gravel, crushed stone, gold, portland cement, and zinc. Washington also ranked second nationwide for the production of olivine.[55] Other minerals produced in the state include common clay and shale, dimension stone,[56] gemstones, lead, peat, sulfur, zinc, aluminum, fire clay, synthetic gypsum, industrial sand, lime, steel, and titanium metal (USGS, 2015f).

8.1.3.8. Geologic Hazards

The three major geologic hazards of concern in Washington are volcanoes, earthquakes, landslides. Land subsidence is not a major threat in Washington, though it is included in the discussion below as there are pockets of karst[57] topography throughout the state.

[55] Olivine: "Olivine is a silicate mineral that contains iron and magnesium." (USGS, 2014h)
[56] Dimension stone: "Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape." (USGS, 2016d)
[57] Karst: "A distinctive landscape (topography) that can develop where the underlying bedrock, often limestone or marble, is partially dissolved by surface or groundwater." (USGS, 2015c)

Volcanoes

Volcanic activity is common in the western part of Washington. Each of the state's five volcanoes has each been active within the last 4,000 years and produced lahars[58] and ash[59] in the last 300 years. Mount St. Helens had a significant eruption in 1980, as well as smaller subsequent events in the 1980s and 2000s. Volcanic eruptions in the Cascades have the potential to produce "huge mudflows of volcanic ash and debris called lahars, [which] can inundate valleys more than 50 miles downstream," and pyroclastic flows,[60] which can greatly impact areas over 10 miles away. Future eruptions may deposit at least four inches of volcanic ash in nearby counties. (Washington Emergency Management Division, 2014)

Spotlight: Mount St. Helens

In May 1980, central Washington's Mount St. Helens erupted. The eruption was preceded by a magnitude 5.1 earthquake and created the largest landslide in recorded history. More than 2.5 cubic kilometers of sediment debris moved off of the mountain's slope and flowed westward toward the North Fork Toutle River. The volcanic blast "devastated an area nearly 19 miles from west to east and 12.5 miles northward from the former summit… Major ash falls occurred as far away as central Montana, and ash fell visibly as far eastward as the Great Plains of the Central United States, more than 930 miles away. The ash cloud spread across the U.S. in three days and circled the Earth in 15 days" (USGS, 2015l).

Earthquakes

The coast of Washington is particularly vulnerable to earthquake activity due to the dozens of active faults and fault zones in the state. Between 1973 and March 2012, there were 75 earthquakes of a magnitude 4.5 (on the Richter scale[61]) or greater in Washington (USGS, 2015g). Earthquakes are the result of large masses of rock moving against each other along fractures called faults. Earthquakes occur when landmasses on opposite sides of a fault suddenly slip past each other; the grinding motion of each landmass sends out shock waves. The vibrations travel through the earth and, if they are strong enough, they can damage manmade structures on the surface (USGS, 2012a).

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

[58] Lahar: "A type of mudflow that originates on the slopes of volcanoes when volcanic ash and debris becomes saturated with water and flows rapidly downslope." (USGS, 2015c)
[59] Ash: "Fine particles of volcanic rock and glass blown into the atmosphere by a volcanic eruption." (USGS, 2015c)
[60] Pyroclastic Flow: "A volcanic eruption that produces a large volume of solid volcanic fragments (pyroclastics) rather than fluid lava. This type of eruption is typical of volcanoes with high silica, viscous, gas-rich magma (USGS, 2015c).
[61] The Richter scale is a numerical scale for expressing the magnitude of an earthquake based on seismograph oscillations. The more destructive earthquakes typically have magnitudes between about 5.5 and 8.9; the scale is logarithmic and a difference of one represents an approximate thirtyfold difference in magnitude (USGS, 2014f).

Oregon, and Alaska (USGS, 2014b). Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale (Oregon Department of Geology, 2015).

Figure 8.1.3-4 depicts the seismic risk throughout Washington; the box surrounding the range of colors shows the seismic hazards in the state. The map indicates levels of horizontal shaking (measured in Peak Ground Acceleration [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 % g. Post-1985 buildings (in California) have experienced only minor damage with shaking of 60 % g. (USGS, 2010)

Ranked as the fifth highest state in terms of earthquake activity, areas of greatest seismicity in Washington are concentrated in the western portions of the state. In particular, locations near the Cascadia Subduction Zone are at the greatest risk of experiencing a significant earthquake event. Earthquakes occur almost every day in Washington, though most are imperceptible to humans (USGS, 2015h) (Washington State Department of Natural Resources, 2015c). Approximately 15 earthquakes with a magnitude greater than 5.0 have occurred in Washington since 1870 (Washington State Department of Natural Resources, 2015c). The largest earthquake recorded to date in Washington occurred on December 14, 1872, near Lake Chelan in north-central Washington. The registered 6.8-magnitude earthquake was “felt from British Columbia, Canada, to Oregon and from the Pacific Ocean to Montana.” Even though it occurred in a wilderness area that had very few inhabitants at the time, it caused “huge landslides, massive fissures in the ground and a 9-meter-high geyser” (USGS, 2012b).

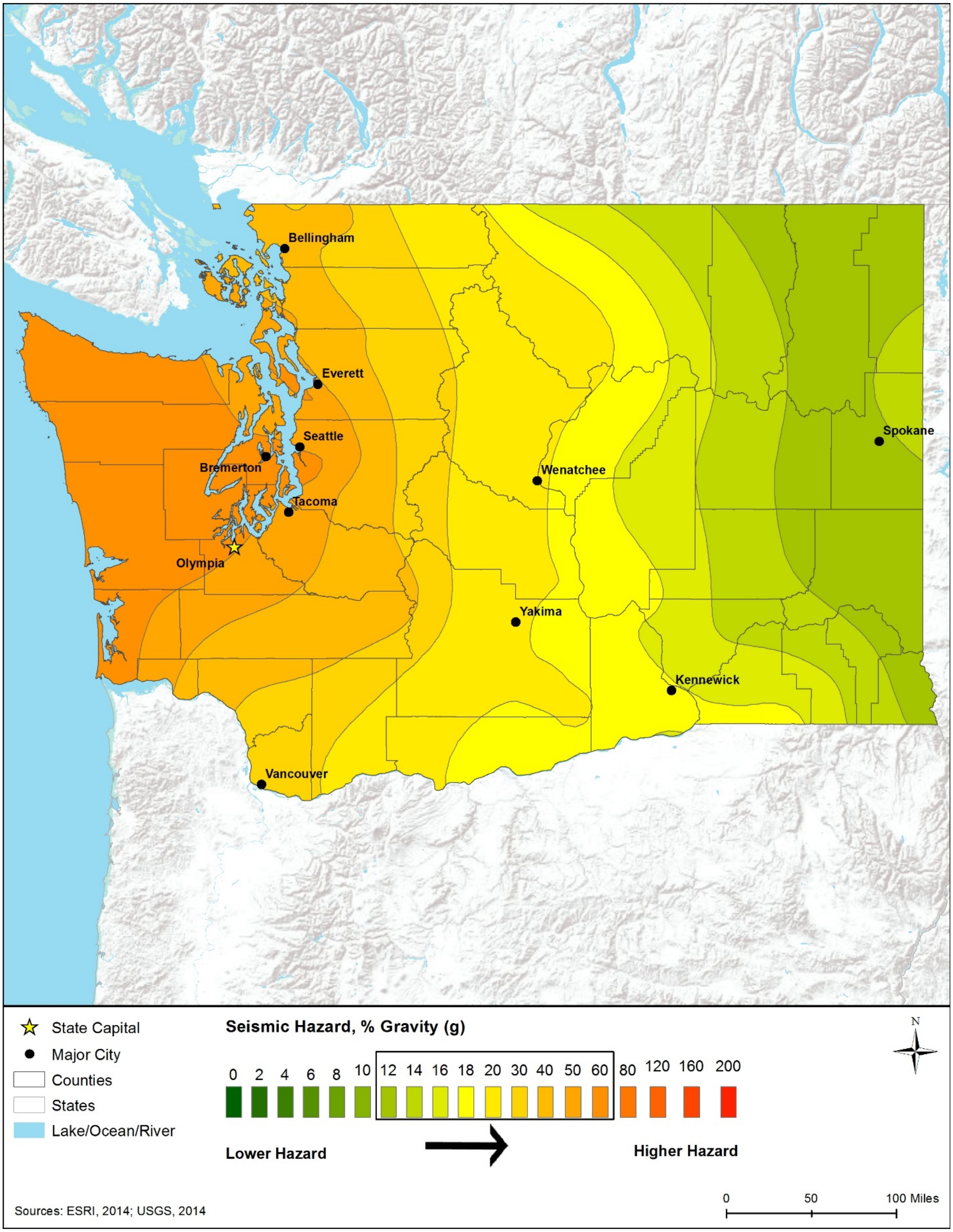


Figure 8.1.3-4: Washington 2014 Seismic Hazard Map

Landslides

Portions of Washington, particularly along the Snake and Columbia Rivers, Puget Sound coastline, and western portion of the Olympic Peninsula are highly susceptible to landslide events (Figure 8.1.3-5). "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." Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale (USGS, 2003a).

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

"Washington is one of the most landslide-prone states in the country, with hundreds to thousands of events each year." Within Washington, the most common causes of landslides include: prolonged or intense rainfall; earthquakes; rapid water level changes along dams, rivers, and coastlines; human activity (e.g., vegetation removal, mining, loading); and weak underlying geology (i.e., sandy and clay-rich soils are most susceptible to landslides) (Washington Division of Geology and Earth Resources, 2015). Between 1984 and 2014, Washington recorded 28 significant landslide events. The 2014 Oso Landslide in northwestern Washington resulted in 43 deaths, and is considered the deadliest landslide in U.S. history. In total, the movement of 10 million cubic yards of terrain resulted in the destruction of 49 homes and flooding of 0.55 square miles of river valley. Another noteworthy landslide event, the "Nile Landslide," event occurred in south-central Washington in Yakima County in October 2009. This event resulted in the movement of 40 million cubic yards of terrain, buried one residence, and destroyed nearly 0.5 miles of State Route 410 (Washington State Department of Natural Resources, 2015d). Figure 8.1.3-5 shows landslide incidence and susceptibility throughout Washington.

Photo of the 2009 Nile Landslide

Source: (Washington State Department of Natural Resources, 2015e)

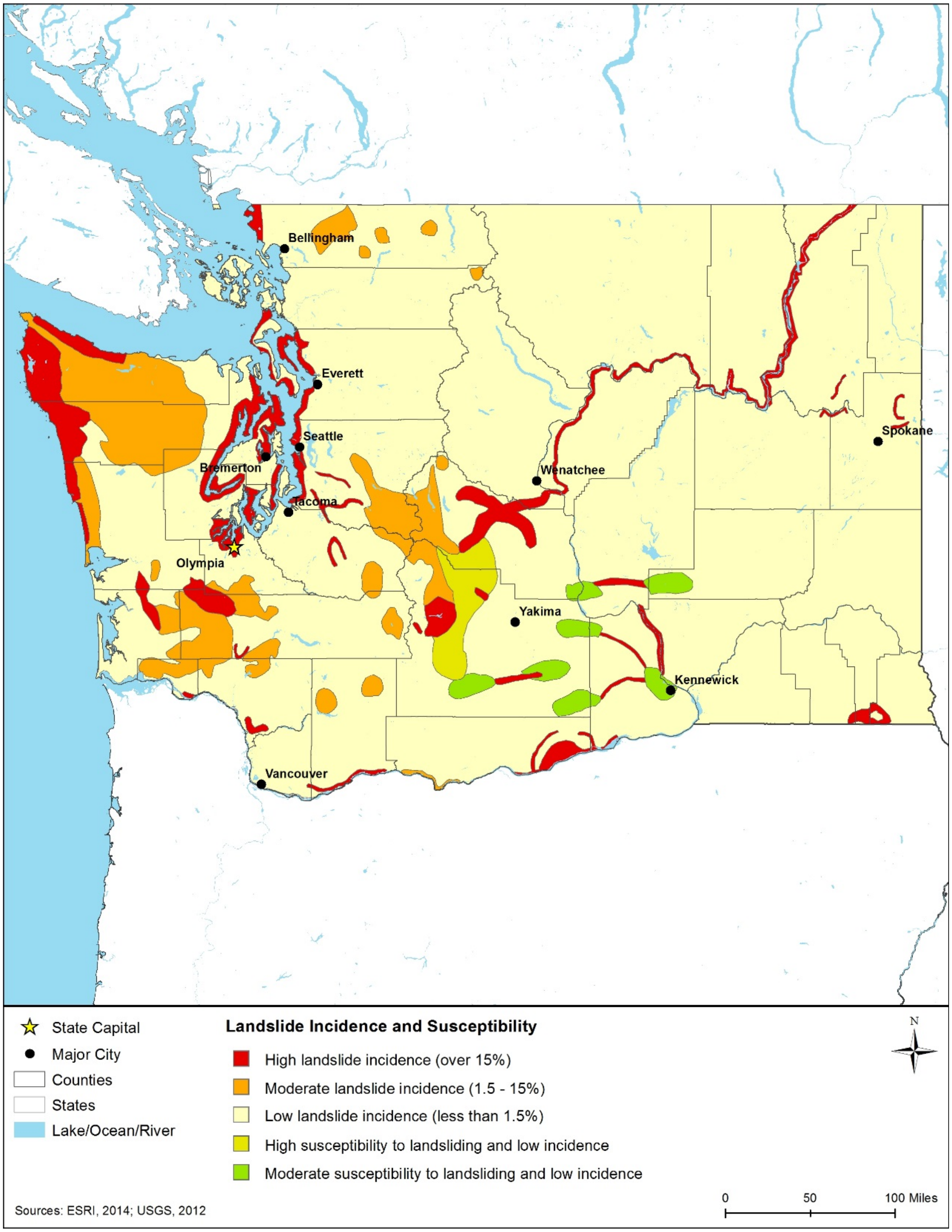


Figure 8.1.3-5: Washington Landslide Incidence and Susceptibility Hazard Map[62]

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

Land Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials." Nationwide, the primary causes of land subsidence are attributed to aquifer system compaction, drainage of organic soils, underground mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the U.S. is a consequence of 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 layers of silt or clay, which do not transport groundwater, confine an aquifer, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the permanent lowering of the land surface elevation (USGS, 2000).

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

Although portions of Washington are underlain by karst topography, the threat of land subsidence in Washington is not considered to be a major threat. Land subsidence is not included as a geologic hazard on the state's geologic hazard page (Washington State Department of Natural Resources, 2015k) nor is it included in the state's Enhanced Hazard Mitigation Plan (Washington Emergency Management Division, 2014). Figure 8.1.3-6 shows the location of areas in Washington that are underlain by karst topography.

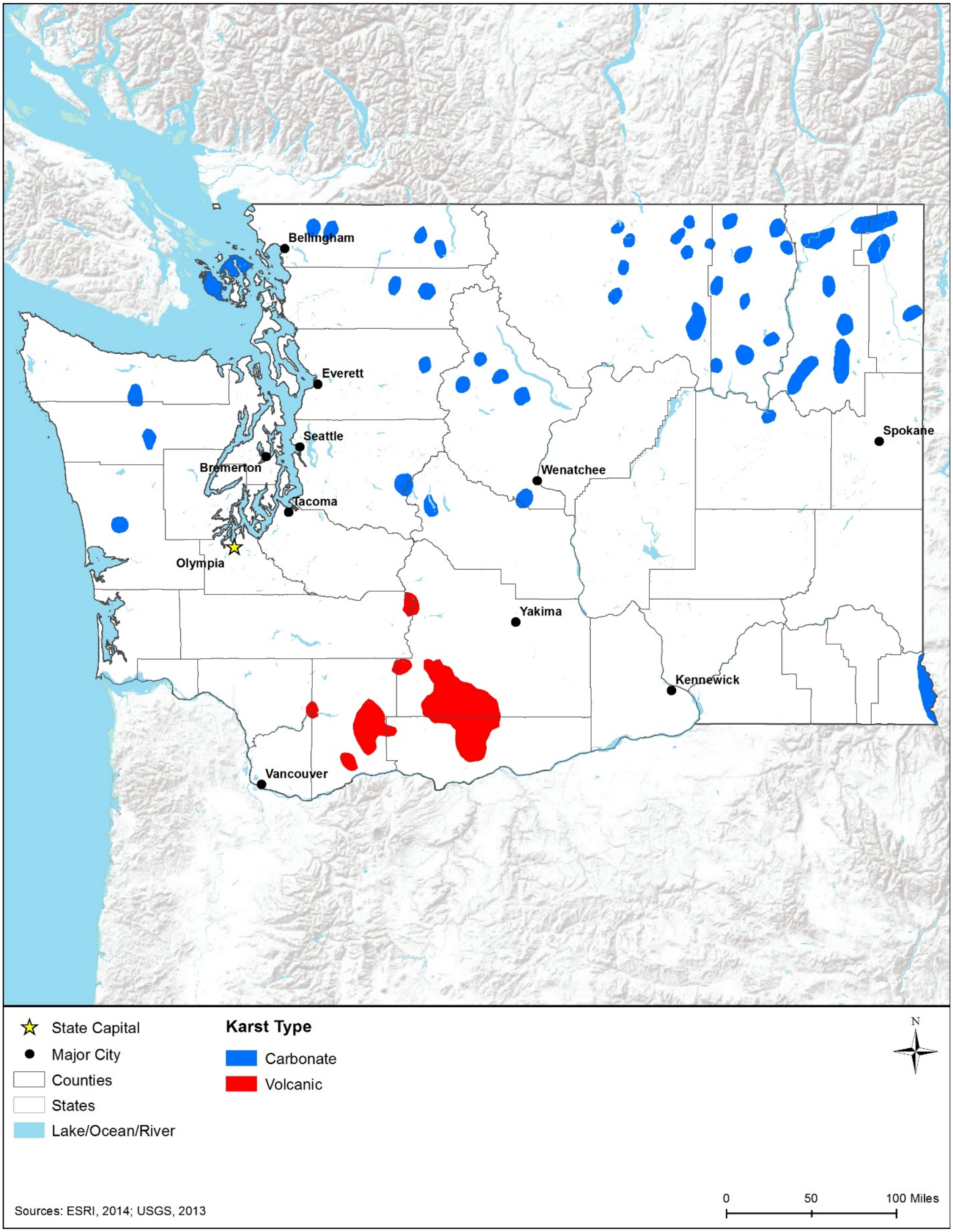


Figure 8.1.3-6: Areas Susceptible to Subsidence due to Karst Topography in Washington

8.1.4. Water Resources

8.1.4.1. Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine waters, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 8.1.5). These resources can be grouped into watersheds, which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for available water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human health, economic wellbeing, and ecological health. (USGS, 2014c)

8.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders" next to the text referring to Appendix C. Table 8.1.4-1 summarizes the major Washington state laws and permitting requirements relevant to the state's water resources.

Table 8.1.4-1: Relevant Washington Water Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
RCW 90.54, the Water Resources Act of 1971, Chapter 173-500 series of WACs	Washington State Department of Ecology	Defines Washington water permit requirements.
Clean Water Act (CWA) Section 404 permit, Washington regional requirements	U.S. Army Corps of Engineers (USACE), Seattle District	Preconstruction Notification is required before activities in Commencement Bay Study Area and any project crossing waters of the U.S; Nationwide Permit are not authorize in Puget Sound tidal areas.
CWA Section 401 Water Quality Certification	Washington DOE	Any activity that might result in a discharge of dredge or fill material into water or non-isolated wetlands or excavation in water or non-isolated wetlands.
NPDES Construction Stormwater	Washington DOE	Construction activities that disturb one or more acres of land and have potential stormwater or storm drain discharge to surface water.
Aquatic Use Authorization	Washington State Department of Natural Resources	Allows use of state-owned aquatic lands. Aquatic lands are defined as tidelands, shorelands, harbor areas, and the beds of navigable waters.

8.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams, as well as estuarine[63] and coastal waters. According to the Washington DOE, there are approximately 4,000 lakes, 74,000 miles of rivers, and nearly 3,000 square miles of marine estuaries. These surface waters supply drinking water; aquatic habitat; and support recreation, tourism, agriculture, fishing, power generation, and manufacturing across the state (Washington Department of Ecology, 2014b).

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains streams and rainfall to a common outlet (e.g., reservoir, bay). Washington's waters (lakes, rivers, and streams) are divided into 8 major watersheds, or drainage basins (Figure 8.1.4-1), Puget Sound, Upper Columbia, Kootenai-Pend Oreille-Spokane, Lower Snake, Yakima, Middle Columbia, Lower Columbia, and Oregon-Washington Coastal. For more information and additional maps about each of Washington's watershed locations, sizes, and water quality, visit the Washington DOE's website (http://www.ecy.wa.gov/geographic/basins.html).

The two largest watersheds are the Upper Columbia and Puget Sound watersheds. The Upper Columbia Watershed extends from the northern border with Canada towards the southern border with Oregon. The Puget Sound Watershed is west of the Upper Columbia Watershed and covers the northwestern region of the state. The Yakima Watershed is located in southcentral Washington. This watershed has received national attention to address water supply issues. The current water supply is not sufficient to meet instream demands for fish and wildlife and out-of-stream demands for irrigation and municipal uses. An Integrated Plan has been proposed to increase instream flows and implement water projects increase storage capacity (Washington Department of Ecology, 2015h).

Freshwater

As shown in Figure 8.1.4-1, there are four major rivers in Washington: Yakima, Snake, Spokane, and Columbia. The Yakima River begins in southcentral Washington on the east side of the Cascade Mountains. The river flows over 200 hundred miles before the confluence with the Columbia River (Washington Department of Ecology, 2013a). The Snake River extends from the eastern border with Idaho to its mouth with the Columbia River in the southeastern portion of the state. There are four hydroelectric projects on the Snake River in Washington (Washington Department of Ecology, 2003). The Spokane River enters from Idaho and continues 112 miles to Lake Roosevelt on the Upper Columbia River. There are two major tributaries and seven hydropower dams (Washington Department of Ecology, 2015i). The Columbia River enters northeast Washington across the border from Canada and flows south to the border with Oregon where it heads west and empties into the Pacific Ocean. Washington

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

Figure 8.1.4-1: Major Washington Watersheds and Surface Waterbodies

also contains about 4,000 lakes, many of which are classified as reservoirs (Washington Department of Ecology, 2014b).

Estuarine and Coastal Waters

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

Washington has three distinct coastal water environments: the Pacific Ocean coastal area, the lower Columbia River estuary, and the Puget Sound basin or marine inlet. Estuarine environments occur in each of these three areas. Washington's total coastal area encompasses about 2,337 miles with 76 percent of this area within the Puget Sound (Washington Department of Ecology, 2007a). Information on Washington's estuaries is available on the Washington DOE Coastal and Estuarine Land Conservation Program site (www.ecy.wa.gov/programs/sea/wetlands/stewardship/celcp.html).

Washington has three areas major areas along the Pacific coast that include estuaries (Figure 8.1.4-1).

- The Pacific Ocean coastal area supports habitat for a variety of shorebird and migratory bird populations. Grays Harbor and Willapa Bay, two of North America's largest west coast estuaries, are located in this area. There are 89 miles of marine shoreline in Grays Harbor and 129 miles in Willapa Bay. Threats to water quality in this area include water pollution from failing septic systems and industrial and agricultural operations, timber harvesting, and development. (Washington Department of Ecology, 2007a)
- The Lower Columbia River Estuary stretches between Oregon and Washington along the Pacific Coast and upriver to Bonneville Dam. In 1995, the USEPA's National Estuary Program recognized the Lower Columbia River Estuary as an Estuary of National Significance (USEPA, 2014a). The Lower Columbia River Estuary's Comprehensive Conservation and Management Plan (CCMP) identified 17 actions. Water quality and contaminant reduction actions were expanded, helping to sustain regional monitoring of toxic and conventional pollutant, reduce conventional pollutants, and cleanup reduce, or eliminate toxic contaminants, particularly contaminants of regional concern. (Lower Columbia Estuary Partnership, 2011) For more information on the Lower Columbia River Estuary and CCMP, access the USEPA's website (visit http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2).
- The Puget Sound area has more than 10,000 streams and rivers that drain into it. There are approximately 1,800 miles of shoreline consisting of beaches, bluffs, deltas, mudflats, and wetlands. The water quality in the Puget Sound has been impacted by land development, agricultural operations, and industry. The U.S. Congress designated Puget Sound as an Estuary of National Significance because of the national importance of the estuary's environmental and economic values. The Action Agenda for Puget Sound identifies specific actions to improve the water quality and restore the health of the Puget Sound. The Action Agenda serves as the CCMP for Puget Sound. The actions identified for 2014 and 2015

consist of preventing pollution from urban stormwater runoff, protecting, and restoring habitat, and recovering shellfish beds. (Puget Sound Partnership, 2015) For more information on the Action Agenda for Puget Sound, access the Puget Sound Partnership website (http://psp.wa.gov/action_agenda_center.php).

8.1.4.4. Sensitive or Protected Waterbodies

Wild and Scenic Rivers

Six river segments in Washington are part of the National Wild and Scenic Rivers System. They include Illabot Creek, Klickitat River, Pratt River, Snoqualmie (Middle Fork) River, Skagit River, and White Salmon River. Washington Appendix A, Table A-1, provides a description of the Wild and Scenic Rivers in Washington.

- Illabot Creek, from the headwaters to approximately two miles upstream from the confluence with the Skagit River, is a federally designated National Wild and Scenic River in Washington (Figure 8.1.4-1). Of the 14.3 total miles, 4.3 are designated as Wild and 10 miles as Scenic. The creek is recognized for its free-flowing characteristics, water quality, and fishery and wildlife values (National Wild and Scenic Rivers System, 2015a).
- The Klickitat River is a tributary to the Columbia River in southcentral Washington. An approximate 10.8-mile segment is designated as Recreational. This segment of the river is known for its high flowrates, water quality, and fishery and wildlife values (National Wild and Scenic Rivers System, 2015a).
- The Pratt River is in western Washington, about 30 miles east of Seattle. The 9.5-mile segment is designated as Wild for its scenic qualities and free-flowing characteristics (National Wild and Scenic Rivers System, 2015a).
- The Snoqualmie (Middle Fork) River is east of Seattle near the Pratt River. Of the total 27.4-mile segment, 6.5 miles are designated as Wild and 21 miles are designated as Scenic. The segment provides recreation opportunities (National Wild and Scenic Rivers System, 2015a).
- The Skagit River is in northwest Washington. The 158.5-mile segment includes 100 miles designated as Scenic and 58.5 miles designated as Recreational. The river is the largest river draining to the Puget Sound. This segment of the river provides recreation opportunities and has fisheries, wildlife, and ecological values (National Wild and Scenic Rivers System, 2015a).
- The White Salmon River is in southcentral Washington. Of the total 27.7-mile segment, 6.7 miles are designated as Wild and 21 miles are designated as Scenic. This segment is known for recreation and rainbow trout habitat (National Wild and Scenic Rivers System, 2015a).

State Designated Critical Resource Waters

In Washington, critical resource waters include Padilla Bay National Estuarine Research Reserve (NERR) (USACE — Seattle District, 2012). The Padilla Bay NERR is located north of Seattle and protects one of the largest eelgrass beds in the United States. The NERR covers 8,000 acres in the northern portion of the Puget Sound. Water quality in the freshwater sloughs is generally poor due to high amounts of suspended solids, wide temperature fluctuations, and pollution from agricultural operations, and failing septic tank systems (NOAA, 2015a) (Padilla Bay National Estuarine Research Reserve, 2013).

8.1.4.5. 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,[64] the causes of impairment, and probable sources. Table 8.1.4-2 summarizes the water quality of Washington's assessed major waterbodies by category, percent impaired, designated use,[65] cause, and probable sources. Figure 8.1.4-2 shows the Section 303(d) waters in Washington as of 2014.

As shown in Table 8.1.4-2, various sources affect Washington's waterbodies, causing impairments. Generally, Washington's surface waters are impaired. Approximately 80 percent of Washington's rivers and streams, 68 percent of the state's lakes and streams, and more than half of Washington's coastal waters are impaired. Designated uses of the impaired waters are not specified. The main causes of impairments include temperature, pathogens, dissolved oxygen, and invasive exotic species. (USEPA, 2008)

Table 8.1.4-2: Section 303(d) Impaired Waters of Washington, 2008

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	97%	80%	Not specified	Temperature, pathogens[c] , and dissolved oxygen	No probable sources of impairments reported
Lakes, Reservoirs, and Ponds	100%	68%	Not specified	Polychlorinated biphenyls, invasive exotic species, temperature	No probable sources of impairments reported
Washington Ocean and Near Coastal	376 miles (total size for ocean and near coastal not available)	53%	Not specified	Pathogens, dissolved oxygen, invasive exotic species	No probable sources of impairments reported

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

Source: (USEPA, 2008)

Starting in 2011, Washington DOE implemented an alternating schedule of marine and fresh water quality assessments. The 2012 assessment addressed freshwater data and the 2014 assessment addressed marine data. State and local agencies and the public collect the data

[64] Impaired waters: waterways that do not meet state water quality standards. Under the CWA, Section 303(d), states, territories, and authorized tribes are required to develop prioritized lists of impaired waters (USEPA, 2015a).
[65] Designated Use: an appropriate intended use by humans and/or aquatic life for a waterbody. Designated uses may include recreation, shellfishing, or drinking water supply (USEPA, 2015a).

evaluated in the assessments. The data is used in the evaluation as long as it meets specific quality control requirements. The Department of Ecology prioritizes projects to address water quality issues based on the risk to threatened and endangered species, public health threats, vulnerability of waterbodies, and the severity of the pollution (Washington Department of Ecology, 2012a). The leading causes of impairment are temperature (31 percent) followed by low dissolved oxygen levels (22 percent). Between 2012 and 2014, the number of waterbody segments proposed for listing increased from 2,686 listings to 3,554 listings. The increase is due to improved monitoring, updated water quality standards, and revisions to the assessment policy (Washington Department of Ecology, 2015t).

8.1.4.6. Floodplains

The Federal Emergency Management Agency (FEMA) defines a floodplain or flood-prone area as “any land area susceptible to being inundated by water from any source” (44 Code of Federal Regulations [CFR] 59.1) (FEMA, 2000).[66] Through FEMA’s flood hazard mapping program, the agency identifies flood hazards and risks associated with the 100-year flood, which is defined as “a flood that has a 1 percent chance of occurring in any given year,” to allow communities to prepare and protect against flood events (FEMA, 2013).

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

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

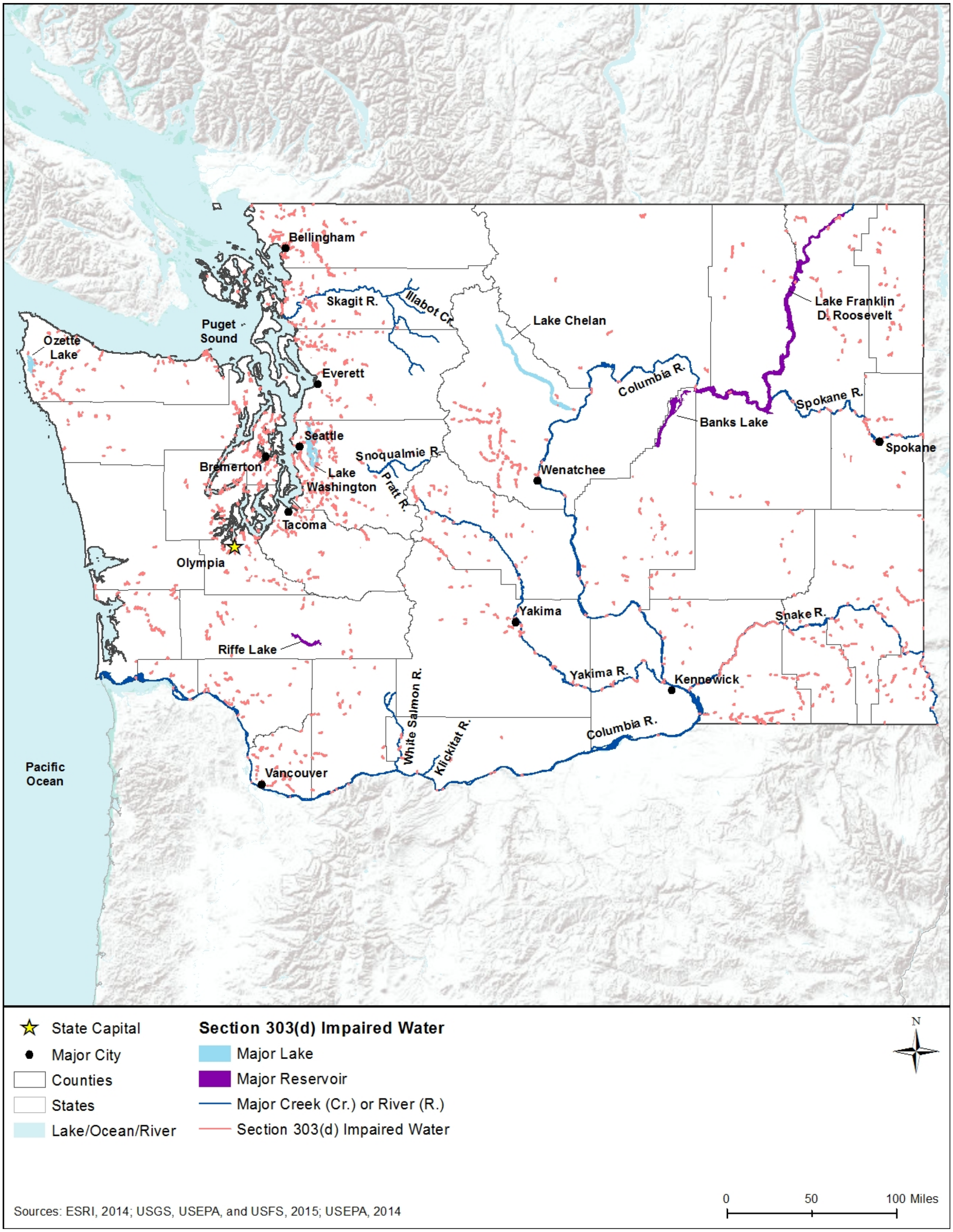


Figure 8.1.4-2: Section 303(d) Impaired Waters of Washington, 2014

There are two primary types of floodplains in Washington.

- 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 (FEMA, 2014b).
- Coastal floodplains in Washington are along the coasts of the Pacific Ocean, Puget Sound, and the Strait of Juan de Fuca. Coastal flooding can occur when strong wind and storms increase water levels on the adjacent shorelines. In addition, a storm surge event that takes place during high tide can cause floodwaters to exceed normal tide levels, resulting from strong winds preventing tidal waters to recede in conjunction with additional water pushed toward the shore (Washington Emergency Management Division, 2014).

Flooding is the leading cause for disaster declaration by the President in the U.S. and results in significant damage throughout the state annually (NOAA, 2015b). There are several causes of flooding in Washington, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. These include severe rain events, rapid snowmelt, subsidence, and dam failure (Washington Emergency Management Division, 2014).

Although some areas, such as floodplains, are more prone to flooding than others, no area in the state is exempt from flood hazards. Based on historical flooding and flood disaster declarations, flood problems are most severe in the Puget Sound, Lower Columbia, and Oregon-Washington Coastal watersheds (see Figure 8.1.4-1). Flooding in Washington is an annual occurrence. In January 2012, a severe winter storm brought heavy snowfall and freezing rain to western Washington. The precipitation lasted five days and caused flooding, landslides, and mudslides in the region. The event cost more than $32 million in public assistance (Washington Emergency Management Division, 2014).

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 292 communities in Washington through the National Flood Insurance Program (NFIP) (FEMA, 2016). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities “to adopt and enforce floodplain management regulations and to implement broader floodplain management programs” and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities for doing more than the minimum NFIP requirements for floodplain management by reducing flood insurance premiums in exchange. As of May 2014, Washington had 33 communities participating in the CRS (FEMA, 2014c).[67]

[67] A list of the 33 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (FEMA, 2014c) and additional program information is available from FEMA’s NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

8.1.4.7. Groundwater

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

Washington's principal aquifers consist of igneous and metamorphic-rock aquifers[68], sandstone aquifers[69], and unconsolidated sand and gravel aquifers. Approximately 60 percent of residents draw drinking water from Washington's groundwater resources. Generally, the water quality of Washington's aquifers is suitable for drinking and daily water needs (Washington Department of Ecology, 2015k). Statewide, threats to groundwater quality include solid waste, pesticide applications, leaking underground storage tanks, septic systems, chemical spills, and saltwater intrusion (saltwater moving into freshwater aquifers) (Washington Department of Ecology, 1997).

Table 8.1.4-3 provides details on aquifer characteristics in the state; Figure 8.1.4-3 shows Washington's principal and sole source aquifers.

Table 8.1.4-3: Description of Washington's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Columbia Plateau basin-fill aquifers Unconsolidated deposits of coarse sand and gravel	Central to south central Washington	Water is generally suitable for most purposes with moderate hardness levels and median nitrate concentrations. Uses include public-supply, domestic, commercial, agricultural, and irrigation.
Pacific Northwest basin-fill aquifers Unconsolidated sand and gravel	Pacific coastal area and northeast portion of Washington	Most productive aquifer in the region. Provides freshwater for most public-supply, domestic, commercial, agricultural, irrigation, and industrial purposes.
Puget Sound aquifer system Unconsolidated sand and gravel	Area surrounding Puget Sound	Not safe for drinking due to natural concentrations of iron and manganese. Median hardness levels. Primary use is for public supply, domestic, commercial, agriculture, and industrial purposes.
Willamette Lowland basin-fill aquifers Unconsolidated sand and gravel	Southwestern portion of the state near the Vancouver area	The aquifer yields high volumes of water. Primary use is for public supply, domestic, commercial, agriculture, and industrial purposes.

[68] Igneous and metamorphic-rock aquifers are formed from lava flow and have variable permeability (how easily water or contaminants can flow through the aquifer/how tight the rocks are pressed together) in Idaho, Oregon and Washington. Basaltic rocks are the most productive aquifers in volcanic rocks (USGS, 2015i).

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

Aquifer Type and Name	Location in State	Groundwater Quality
Northern Rocky Mountains Intermontane Basins aquifer system Clay, fine and coarse sand, and gravel	Spreads throughout southcentral to central Washington	Aquifer consists of unconsolidated sediments where the chemical concentration varies widely due to diverse composition of aquifers. Primary water use is related to the lumber and mining industries, recreational activities, irrigated agriculture, and livestock.
Columbia Plateau basaltic-rock aquifers Basaltic rocks (formed from lava flows)	Covers the majority of the central and southeastern portion of the state	Water is generally suitable for most purposes with moderate hardness levels and higher nitrate concentrations. Uses include public-supply, domestic, commercial, agricultural, irrigation, and industrial.
Pacific Northwest basaltic-rock aquifers Basaltic rocks (formed from lava flows)	Scattered in the southwest and northwest regions	Water is suitable for most uses though primality used for agriculture and irrigation. These aquifers generally yield freshwater but can yield saltwater as well. Most of the fresh groundwater withdrawals are used for irrigation purposes.

Source: (Moody, Carr, Chase, & Paulson, 1986) (USGS, 1994b)

Sole Source Aquifers

The USEPA defines sole source aquifers (SSAs) as "an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and are areas with no other drinking water sources (USEPA, 2015b). Washington has 12 designated SSAs within the state, including two that cross into Idaho (as shown in Figure 8.1.4-3) (USEPA, 2013b). Designating a groundwater resource as an SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized (USEPA, 2015b).

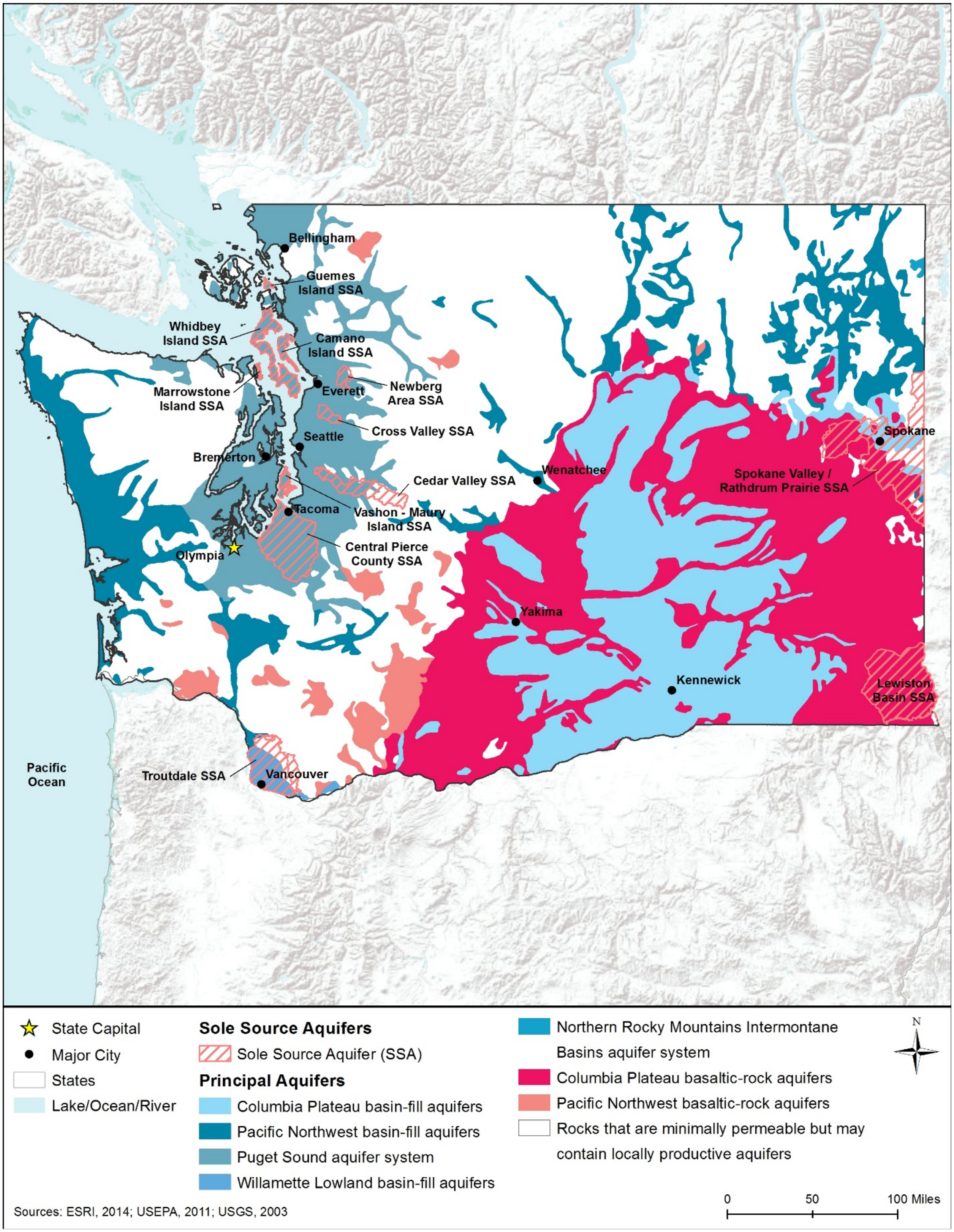


Figure 8.1.4-3: Principal and Sole Source Aquifers of Washington

8.1.5. Wetlands

8.1.5.1. Definition of the Resource

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

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

8.1.5.2. Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, describes the pertinent federal laws protecting wetlands in detail. Table 8.1.5-1 summarizes the major Washington state laws and permitting requirements relevant to the state's wetlands.

Table 8.1.5-1: Relevant Washington Wetland Laws and Regulations

State Law/Regulation	Regulatory Authority	Applicability
Tribal Water Quality Standards (WQS) Program	Confederated Tribes of the Chehalis Reservation, Confederated Tribes of the Colville Reservation, Kalispel Indian Community of the Kalispel Reservation, Lummi Nation, Makah Indian Nation (WA), Port Gamble S'Klallam Tribe, Puyallup Tribe of Indians, and Spokane Tribe of Indians	Listed tribes Washington administer their water quality standards (WQS) program. According to the USEPA, "a tribe may administer a WQS program if it applies and USEPA finds that it qualifies under Section 518(e) of the Clean Water Act to be treated in a manner similar to a state."
CWA Section 404 permit, Washington regional requirements	USACE, Seattle District	No authorized regulated activity can cause the loss of waters of the U.S. in a mature forested wetland, bog, bog-like wetlands, aspen-dominated wetlands, alkali wetlands, wetlands in a dunal system along the Washington coast, vernal pools, camas prairie wetlands, estuarine wetlands, and wetlands in coastal lagoons. Compensating for adverse impacts to high value aquatic resources is typically difficult, prohibitively expensive, and may not be possible in some landscape settings.

State Law/Regulation	Regulatory Authority	Applicability
CWA Section 401 Water Quality Certification	Washington DOE	Any activity that might result in a discharge of dredge or fill material into waters of the state[70] or wetlands[71] or excavation in water or wetlands.
Water Pollution Control Act	Washington DOE	Authorization required for discharging pollutants in waters of the state. Waters of the state includes wetlands.
Growth Management Act	Local jurisdiction, Department of Commerce	All jurisdictions in the state are required to designate and protect wetlands as critical areas.
Shoreline Management Act	Local jurisdiction, Washington DOE	Requires a permit to ensure that proposed activity complies with local shoreline master plan; includes all land within 200 feet of ordinary high water mark[72] of a state shoreline, and may be extended to include an entire associated wetland.
Floodplain Management Program	Local jurisdiction, Washington DOE	Regulates construction and other activities that might increase flood flow; covers wetlands incidentally.
Forest Practices Act	Washington State Department of Natural Resources	Permit required for some forestry related activities (e.g., harvest and road building). Restricts harvest activities in and around certain types of wetlands.
State Hydraulic Code	Washington Department of Fish and Wildlife	Requires a permit for all work that occurs below the ordinary high water mark of state waters, including portions of wetlands.
Local Regulations	Local jurisdiction	May identify specific wetlands or performance standards. May vary widely from jurisdiction to jurisdiction.

Washington legislation requires local governments to use the *Washington State Wetlands Identification and Delineation Manual* to identify a wetland's boundary. The state manual is based on the 1987 USACE wetlands delineation manual and incorporates USACE's updates. Additionally, all delineations must include a Washington DOE Wetland Rating form. (Granger, et al., 2005)

8.1.5.3. 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 et al. (1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine (as detailed in Table 8.1.5-2). The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats. (Cowardin, et al. 1979)

- "The Marine System consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the Water Regimes are determined primarily by the ebb and flow of

[70] Waters of the state include lakes, rivers, ponds, streams, inland waters, underground waters, wetlands, salt waters and all other surface waters and watercourses within the jurisdiction of the state of Washington, RCW 90.48.020.
[71] Waters of the state makes no distinction between isolated and non-isolated wetlands. Isolated wetlands are protected under state and local laws and rules (Washington Department of Ecology, 2015l).
[72] Information on the state's definition of the Ordinary High Water Mark (OHWM) can be found http://www.ecy.wa.gov/programs/sea/sma/st_guide/jurisdiction/OHWM.html.

oceanic tides. Salinities exceed 30 parts per thousand (ppt), with little or no dilution except outside the mouths of estuaries." Where wave energy is low, mangroves or mudflats may be present.

- "The Estuarine System consists of deepwater tidal habitats and adjacent tidal habitats that are usually semi-enclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and the ocean water is at least occasionally diluted by freshwater runoff from the land."
- "Riverine System includes all wetlands and deepwater habitats contained within a channel with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 ppt".
- Lacustrine System includes inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30 percent vegetation cover, and occupy greater than 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc.
- "Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent." The System is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types). (Cowardin, et al. 1979) (FGDC, 2013)

In Washington, the main type of wetlands are palustrine (freshwater) wetlands found on river and lake floodplains across the state, as shown in Figure 8.1.5-1. Lacustrine wetlands, as defined in Table 8.1.5-2, comprise approximately two percent (17,133 acres) of the wetlands in the state and are therefore not discussed in this PEIS.

Table 8.1.5-2 uses 2014 NWI data to characterize and map Washington wetlands on a broad-scale.[73] The data is not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known. The map codes and colorings in Table 8.1.5-2 correspond to the wetland types in the figures.

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

Table 8.1.5-2: Washington 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 and hardwood swamps are examples of PFO wetlands.	Forested lowlands within the state	313,141
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.	Throughout the state, often on river and lake floodplains	
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,[74] prairie potholes, and sloughs.	Throughout the state, more on the western half of the state	339,180
Palustrine unconsolidated bottom	PUB	PUB and PAB wetlands are commonly known as freshwater ponds, and includes all wetlands with at least 25% cover of particles smaller than stones and a vegetative cover less than 30%.	Distributed throughout the state	48,457
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[75], and other miscellaneous wetlands are included in this group.	Abandoned fields, depressions (seeps), along hillsides and highways	3,921
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, along the southern edge	106,624
Lacustrine wetland	L2	Lacustrine systems are lakes or shallow reservoir basins generally consisting of ponded waters in depressions or dammed river channels, with sparse or lacking persistent emergent vegetation, but including any areas with abundant submerged or floating-leaved aquatic vegetation. These wetlands are less than 8.2 feet deep.	Scattered throughout the state	17,133

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

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Estuarine and Marine intertidal wetland	E2/M2	These intertidal wetlands include the areas between the highest tide level and the lowest tide level. Semidiurnal tides (two high tides and two low tides per day) periodically expose and flood the substrate. Wetland examples include vegetated and non-vegetated brackish (mix of fresh and saltwater), and saltwater marshes, shrubs, beaches, sandbars, or flats.	Along the Pacific coast, in the western half of the state	44,088
			TOTAL	**872,544**

Source: (Cowardin, et al. 1979) (USFWS, 2015b) (FGDC, 2013)

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

In the 1780s, Washington had 1.35 million acres of wetlands, and according to a 1990 report, the state lost 31 percent of their wetlands for a total of 938,000 acres (Washington Department of Ecology, 2015m). Based on the USFWS NWI 2014 analysis, there are currently approximately 872,544 acres of wetlands in the state (USFWS, 2014a). Main threats to wetlands in Washington include draining and filling for agricultural, urban growth and development (Michaud, 2001).

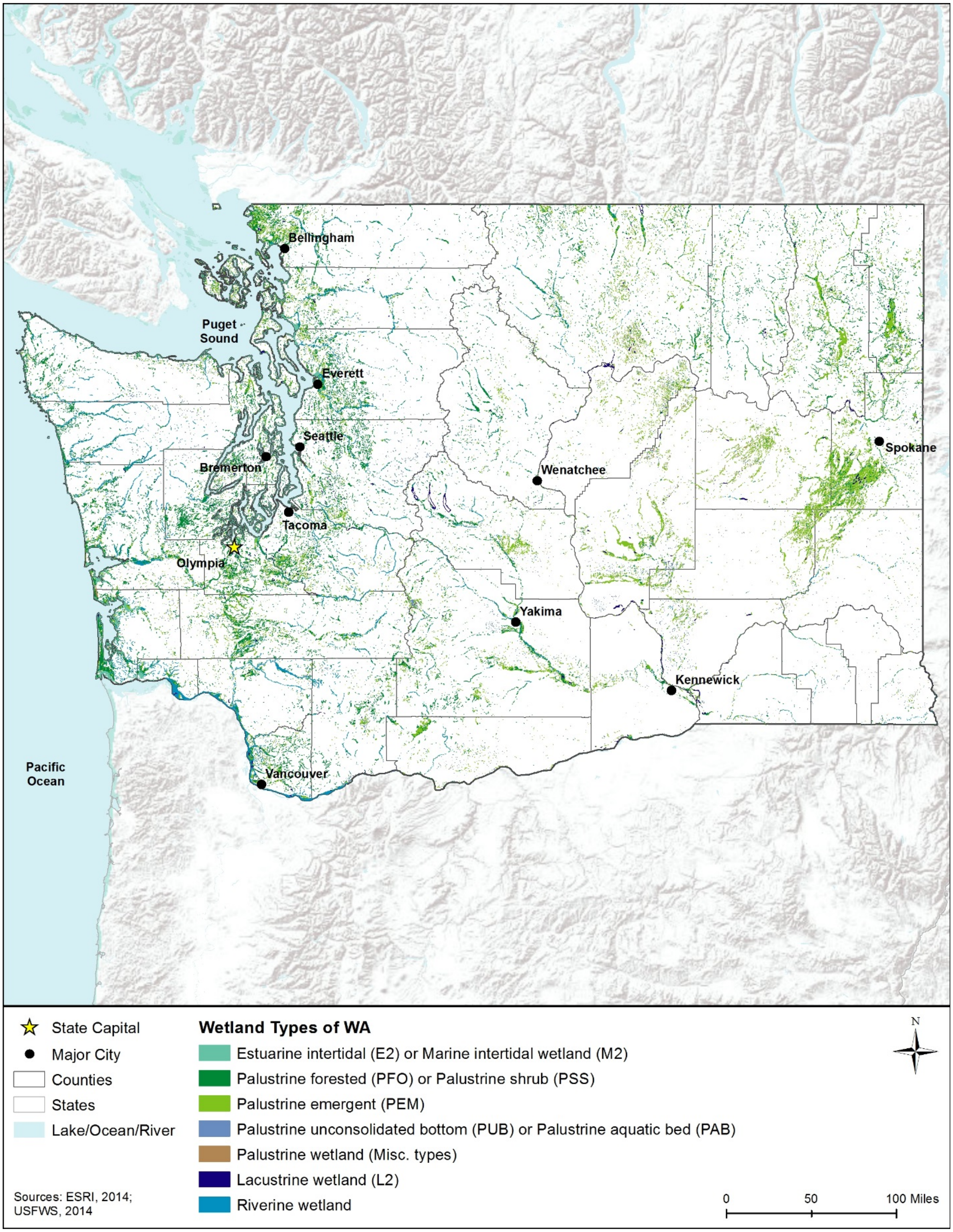


Figure 8.1.5-1: Wetlands by Type, in Washington, 2014

Palustrine Wetlands

In Washington, palustrine wetlands include the majority (81 percent) of vegetated freshwater wetlands (freshwater marshes, swamps, bogs, and ponds). Palustrine forested (PFO) wetlands include Oregon ash *(Fraxinus latifolia),* paper birch (*Betula papyrifera*), lodgepole pine (*Pinus contorta),* bigleaf maple *(Acer macrophyllum),* peach-leaf willow (*Salix amygdaloides),* and rose (*Rosa spp*.). Evergreen PFO wetlands can include Pacific silver fir (*Abies amabilis*), mountain hemlock (*Tsuga mertensiana*) in the western domain, and Alaska yellow-cedar (*Chamaecyparis nootkatensis*), and Engelmann spruce (*Picea engelmannii*), subalpine fir (*A. lasiocarpa*), western hemlock (*T. heterophylla*), or western redcedar (*Thuja plicata*) on the western domain. Palustrine scrub-shrub (PSS) wetlands vegetation shrub and forested wetlands in eastern and western valleys support species such as red alder (*Alnus rubra*), willows (e.g., Hooker's willow [*Salix hookeriana]*), red-osier dogwood *(Cornus stolonifera),* water parsley (*Oenanthe sarmentosa*), skunk cabbage (*Lysichiton americanus*), salmonberry (*Rubus spectabilis var. spectabilis*), and slough sedge (*Carex obnupta)* (USACE, 2010) (Hubry, Granger, & Teachout, 1999).

Common palustrine emergent (PEM) wetlands in Washington are dominated by the sedges and sedge-like species, such as, water sedge (*Carex aquatilis var dives*), beaked sedge *(C. utriculata)*, livid sedge *(C. livida)*, creeping spikerush *(Eleocharis palustris)*, and common cattail *(Typha latifolia)*. Temporarily flooded emergent vegetation is dominated by grasses and sedges including shrubs such as Labrador tea *(Ledum glandulosum),* sweetgale *(Myrica gale),* and bog blueberry *(Vaccinium uliginosum),* and herbaceous plants including and tufted hairgrass *(Deschampsia cespitosa)*, marshes and wet meadows. PEM wetlands are the most common wetlands in the state (USACE, 2010) (Hubry, Granger, & Teachout, 1999).

Palustrine wetlands also include the shallow water zones of lakes, rivers, and ponds and aquatic beds (PAB/PUB) formed by water lilies and other floating-leaved or free-floating plants. Cattails are often found growing in or around PAB/PUB wetlands in Washington, and they offer important breeding grounds for waterfowl and other wildlife. These are the easiest wetlands to recognize and occur throughout the state. Common emergent and floating vegetation (eastern and western areas) includes species of cattail, rush *(Juncus spp)*, pondweed *(Potamogeton spp*), yellow pondlily (*Nuphar lutea)*, and Eurasian watermilfoil *(Myriophyllum spicatum)* (USACE, 2010) (Hubry, Granger, & Teachout, 1999).

Lacustrine Wetlands

As noted in Table 8.1.5-2, Lacustrine wetlands in Washington comprise just over 17,000 acres or slightly less than 2 percent of the state's wetlands, which include lakes or shallow reservoir basins generally consisting of ponded waters in depressions or dammed river channels, with sparse or lacking persistent emergent vegetation, but including any areas with abundant submerged or floating-leaved aquatic vegetation. (Cowardin, et al. 1979) (USFWS, 2015b) (FGDC, 2013)

According to the USGS, "Lacustrine emergent wetlands and aquatic beds exist in the shallows of lakes throughout Washington. Predominant emergent vegetation includes duckweed

(*Lemnoideae*), water lilies (*Nymphaeaceae*), water buttercup (*Ranunculus*), arrowhead (*Sagittaria latifolia*), water plantain (*Alisma*), smartweed (*Polygonum hydropiperoides*), yellow water lily (*Nuphar lutea*), common mare's tail (*Hippuris vulgaris*), and pondweed (*Potamogeton*)." (USGS, 1997)

Riverine Wetlands

The distinguishing characteristic of riverine wetlands in Washington is that they are frequently flooded by overbank flow from a stream or river. Riverine wetlands are found in a valley or adjacent to a stream channel. Riverine wetlands in some regions of Washington are defined by the frequency of overbank flooding (Hubry, Granger, & Teachout, 1999) (Sheldon, et al., 2005). There are approximately 106,624 acres of riverine wetlands in the state, or 12 percent of the total wetlands (USFWS, 2014a). These are usually dominated by red alder with other species such as black cottonwood (*Populus balsamifera*) white alder (*Alnus rhombifolia)*, quaking aspen (*Populus tremuloides*), water birch, and ponderosa pine (*Pinus ponderosa*) (USACE, 2010). Common species underneath the tree layer include salmonberry, red-osier dogwood, Labrador tea, thimbleberry (*Rubus parviflorus*), common snowberry (*Symphoricarpos albus*), beaked hazel (*Corylus cornuta*), and Pacific ninebark (*Physocarpus capitatus*). Understory dominant herbs include slough sedge, Dewey sedge (*C. deweyana*), Sitka sedge (*C. aquatilis* var. *dives*), skunk cabbage, coltsfoot (*Petasites frigidus*), great hedge-nettle (*Stachys ciliata*), great burnet (*Sanguisorba officinalis*), blue wildrye (*Elymus glaucus*), Pacific golden saxifrage (*Chrysoplenium glechomifolium*), and field horsetail (*Equisetum arvense*) (Hubry, Granger, & Teachout, 1999).

Estuarine and Marine Wetlands

In Washington, estuarine/marine wetlands have developed in the shallow; low-gradient reaches near the mouths of Washington's coastal rivers and in their deltas; Columbia River estuary, Willapa Bay, Grays Harbor, Skagit Bay, the Nooksack River delta, the Nisqually River delta, and several river deltas in Hood Canal. Estuarine/marine wetlands in the state include tideflats, eelgrass beds, and salt marshes. Eelgrass-bed (aquatic-bed) wetlands are tideflats that have been extensively colonized by eelgrass *(Zostera spp)*, a plant that can tolerate high salinity and periods of exposure. Tideflats (unconsolidated-shore wetlands) are mostly nonvegetated and exist where tides flood and expose the areas daily. Tideflats bordering salt marshes often are co-dominated by pickleweed (*Salicornia virginica*), arrowgrass (*Triglochin maritima*), and three-square rush *(Scirpus americanus)*. Salt marshes are regularly to irregularly flooded emergent wetlands

Source: (USFWS, 2013d)

Figure 8.1.5-2. Salt Marsh

vegetated by salt-tolerant plants such as rushes, sedges, and woody saltwort *(Salicornia depressa).* Major components of mid- and high salt marsh areas are alkaligrass (*Puccinellia pumila*) and Canadian sand spurry (*Spergularia canadensis*). Salt rush (*Juncus lesueurii*), tufted hairgrass (*Deschampsia caespitosa*), Pacific silverweed (*Argentina egedii*) and spreading bentgrass (*Agrostis stolonifera*) are also common to salt marshes in Washington (Washington Department of Ecology, 2007a).

There are approximately 44,088 acres of estuarine and marine wetlands in the state, or 5 percent of the total wetlands (USFWS, 2014a). Estuarine wetland losses in Washington have been caused by filling or excavation for transportation and commercial development. Additionally, land subsidence and sea level rise have contributed to estuarine/marine wetland loss along the coast (USACE, 2010) (Washington Department of Ecology, 2007a).

8.1.5.4. Environmental Setting: Wetlands of Special Concern or Value

In addition to protections under the state's wetlands regulations, national CWA, and USACE regional requirements, Washington considers certain wetland communities as areas of special value due to their global or regional scarcity, "unusual local importance," or habitat they support. Under the USACE NWP Regional Requirements for Washington, "no authorized regulated activity can cause the loss of waters of the U.S. in a mature forested wetland, bog, bog-like wetlands, aspen-dominated wetlands, alkali wetlands, and wetlands in a dunal system along the Washington coast, vernal pools, camas prairie wetlands, estuarine wetlands, and wetlands in coastal lagoons (USACE — Seattle District, 2012). Compensatory mitigation for these "high value aquatic resources" is typically difficulty, prohibitively expensive, and may not be possible in some landscape settings. These wetlands, some of which are high quality, are described below.

Mature Forested Wetland

USACE has two definitions for mature forested wetlands, based on region. In western Washington, 50 percent of the cover of the upper forest canopy must consist of evergreen trees older than 80 years or deciduous trees older than 50 years, or 50 percent of the forest canopy must consist of trees taller than 50 feet. Structurally, mature forested wetlands in western Washington must include a multi-layer community consisting of trees greater than 50 feet tall, trees between 20 feet and 49 feet tall, shrubs, and an herbaceous groundcover (USACE — Seattle District, 2012) (Hubry, 2014a). In eastern Washington, the average age of dominant trees must be greater than 80 years, or the average age of dominant trees in the forested wetland must be between 50 and 80 years (USACE — Seattle District, 2012). Common species found in mature forested wetlands are western red cedar, Alaska yellow cedar, pine species (mostly western white pine, *Pinus monticola*), western hemlock, Oregon white oak *(Quercus garryana)*, and Engelmann spruce (Hubry, 2014b) (Sheldon, et al., 2005).

Bogs and Bog-like Wetlands

Bogs are acidic wetlands that form thick organic (peat) deposits up to 50 feet deep or more. They have little groundwater influence and are recharged through precipitation. The stagnant, nutrient-poor, acidic water slows all processes in a bog, including nutrient recycling, making bogs very sensitive to external disturbance. Bogs often have areas dominated by more than one species of sedge (*Carex* spp.) or beakrush (*Rhynchospora alba*), Labrador tea, and sphagnum moss (*Sphagnum* spp.) that are included within this habitat (USACE — Seattle District, 2012). The rate of peat accumulation, formed by slowly decomposing sphagnum, is generally quite low. In Washington, peat accumulation is estimated at 1 inch in 40 years for the west side of the Cascades and 1 inch in 50 years on the east side (Sheldon, et al., 2005).

Aspen Wetland Forests

Aspen wetland forests have quaking aspen as the dominant or co-dominant species among the woody vegetation. Aspen stands in a forest provide important habitat in the state. Aspen regenerate through an underground root system; regeneration of aspen stands by sexually produced seeds is an unusual phenomenon (USACE — Seattle District, 2012). Characteristic understory grasses include blue wildrye, and shrubs include sagebrush, snowberry (*Symphoricarpos albus* and/or *S. mollis*), serviceberry (*Amelanchier alnifolia*), and roses. Aspen habitats are dependent on disturbance, with fire and blowdown as the major disturbances. Aspen sprouts after fire and spreads in large clones. With no disturbance, other vegetation types replace stands after 50 to 100 years (WDFW, 2005).

Alkali Wetlands

Alaki wetlands are nontidal shallow depressional wetlands with shallow saline (salty) or alkaline (acidic) conditions. Vegetation is usually sparse or consists of species that are able to live in the saline or alkaline conditions. Example species include coastal saltgrass *(Distichlis spicata)*, boraxweed *(Nitrophila occidentalis)*, and bulrush *(Schoenoplectus maritimus)*, smother weed *(Bassia hyssopifolia)*, alkaligrass, and salt meadow cordgrass *(Spartina patens)* (USACE — Seattle District, 2012) (Hubry, Washington State Wetland Rating System for Eastern Washington 2014 Update, 2014b) (Sheldon, et al., 2005).

Vernal Pool

Vernal pools are a type of small, depressional, temporary wetland. The pools occur in shallow depressions that fill from spring or fall precipitation, and are usually dry by late summer or during droughts since they are not connected to a permanent water source. Vernal pools fill from rain, snowmelt, or groundwater. These small wetlands contribute to storage and filtration of surface water and help recharge aquifers. Each vernal pool has distinctive native plant species based on its location within the state. When ponded, vernal pools can provide foraging habitat to various species of migratory birds (USACE — Seattle District, 2012) (Sheldon, et al., 2005).

Wetlands in Dunal System along the Washington Coast

Interdunal wetland are temporary wetlands occurring in depressions in dunes, often between sand dunes where wind has scoured the sand down to the water table (where the groundwater reaches the surface) on the southern portion of the Washington coast. Common plant species include native grasses such as dunegrass (*Leymus mollis*), red fescue (*Festuca rubra)*, and others such as slough sedge, common silverweed, salt rush, golden blue-eyed grass *(Sisyrinchium californicum)* and coastal willow (Sheldon, et al., 2005).

Camas Prairie Wetlands

Prairie wetlands are found in Southwest Washington in "seasonally wet areas such as seepages, depressions, prairies, meadows, hillsides (where moist), moist forests, and streamside areas which are often dry by late spring" (USACE — Seattle District, 2012). The Camas plant *(Cammasia quamash)* dominates the culturally important wetlands. Camas was and continues to be one of the most important "root" foods of western North American indigenous peoples, from southwestern British Columbia to Montana, and south to California. Northwest Coast peoples used camas, including the Coast Salish of Vancouver Island, western Washington groups (Stevens, 2006).

Estuarine Wetlands

Estuarine wetlands are dominated by salt tolerant plant species, as described in Section 8.1.5.3.

Wetlands in Coastal Lagoons

These include "wetlands in a shallow sound, channel, pond, or pool directly connected to tidal waters" (USACE — Seattle District, 2012). Wetlands in coastal lagoons are dominated by salt tolerant species, many similar to estuarine wetlands. Coastal lagoons often contain vegetated areas that are jurisdictional wetlands, and are therefore considered to be of special importance to the state. (Sheldon, et al., 2005) (Hubry, Washington State Wetland Rating System for Western Washington: 2014 Update (Effective January 2015), 2014a)

Other Important Wetland Sites in Washington

- Washington's 33 Wildlife Areas cover nearly 1 million acres across the state. Most of the land owned by Washington Department of Fish and Wildlife is open wetland, riparian shrub habitat, or meadow/field habitat. (WDFW, 2015a) For more information on state Wildlife Areas, access the Washington Department of Fish and Wildlife website *(*http://wdfw.wa.gov/lands/wildlife_areas/intro.html*).*
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state. These include Natural Resources Conservation Service Agricultural Conservation Easement Program and easements managed by natural resource conservation groups such as state land trusts, The Nature Conservancy, Ducks Unlimited, and San Juan Preservation Trust. According to the National Conservation Easement Database (http://conservationeasement.us/), a national electronic repository of government and privately held conservation easements, Kings County Department of Natural Resources and Parks holds more than 141,680 acres in conservation easements in Washington (NCED, 2015).

8.1.6. Biological Resources

8.1.6.1. Introduction

This chapter describes the biological resources for Washington. Biological resources include terrestrial[76] vegetation, wildlife, fisheries and aquatic habitats, and threatened[77] and endangered[78] species, and communities and species of conservation concern. Because of the topographic variation within the state, and its location along the Pacific coast, Washington supports biological resources ranging from marine[79] and estuarine habitat[80] settings along the coast to the west, deciduous[81] and coniferous[82] forests scattered between the coastal regions and central regions of the state, and desert settings in the southeast.

8.1.6.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of biological resources in Washington are summarized in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders next to the text referring to Appendix C. Table 8.1.6-1 summarizes the major state laws relevant to Washington's biological resources.

Table 8.1.6-1: Relevant Washington Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Authority	Applicability
State Environmental Policy Act (SEPA)	Washington DOE	Requires all state and local governments within the state to: "Utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment;" and Ensure that "...environmental amenities and values will be given appropriate consideration in decision making along with economic and technical considerations...." [RCW 43.21C.030(2)(a) and (2)(b)]
Chapter 77.55 RCW of the State Hydraulic code	Washington Department of Fish and Wildlife	The Hydraulic Project Approval is designed to ensure the projects meet state conservation standards for finfish, shellfish, and their aquatic environment.

76 Terrestrial: "Pertaining to the land" (USEPA, 2016a).

77 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))

78 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))

79 Marine: "Any marine environment, from pond to ocean, in which plants and animals interact with the chemical and physical features of the environment" (USEPA, 2016a).

80 Estuarine habitat: "An estuary is the area where a river or stream connects to the open sea or ocean, estuarine includes the estuary and its associated habitats such as seagrasses and shellfish beds" (USEPA, 2016a).

81 Deciduous: "Trees such as oaks and maples that lose their leaves during part of the year" (USEPA, 2016a).

82 Coniferous: "Cone-bearing trees, mostly evergreens that have needle-shaped or scale-like leaves. They produce wood known commercially as softwood" (USEPA, 2016a).

State Law/Regulation	Regulatory Authority	Applicability
NPDES	Washington DOE	Construction stormwater general permit requires controls in place to control offsite water particularly in areas where receiving waters are considered sensitive resources (i.e. waters of the state).
Local Laws for Tree Removal	Local Counties and Cities	Most local jurisdictions in Washington have established tree protection and removal laws/ordinances. Regulations vary depending on jurisdiction.
Local Laws for Shoreline Development	Local Counties and Cities	Provide development code for construction on or in close proximity to Washington shorelines.
Revised Code of Washington RCW 17.10 (basic weed law) WAC chapter 16-750 noxious weed list and boundaries WAC Chapter 16-752 provided the quarantine list	Washington Department of Agriculture and Washington Noxious weed control Board	State noxious weed quarantines prohibit the import, transport, propagation, or sale of a subset of weeds listed on both state and federal noxious weed lists.

8.1.6.3. Terrestrial Vegetation

The distribution of flora within Washington is a function of the characteristic geology[83], soils, climate[84], and water of a given geographic area and correlates to distinct areas identified as ecoregions[85]. Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions and represent ecosystems contained within a region. The boundaries of an ecoregion are not fixed, but rather depict a general area with similar ecosystem types, functions, and qualities (National Wildlife Federation, 2015) (USDA, 2015a) (World Wildlife Fund, 2015).

Ecoregion boundaries often coincide with physiographic[86] regions of a state. The ecoregions mapped by the USEPA are the most commonly referenced, although individual states and organizations have also defined ecoregions that may differ slightly from those designated by the USEPA. The USEPA divides North America into 15 broad Level I ecoregions. These Level I ecoregions are further divided into 50 Level II ecoregions. These Level II ecoregions are further divided into 182 smaller Level III ecoregions. This Section provides an overview of the terrestrial vegetation resources for Washington at USEPA Level III. (USEPA, 2016b)

As shown in Figure 8.1.6-1, the USEPA divides Washington into nine Level III ecoregions: Coast Range, Puget Lowland, Willamette Valley, Cascades, Eastern Cascades Slopes and Foothills, Columbia Plateau, Blue Mountains, Northern Rockies, and North Cascades.

[83] Geology: "The study of the planet earth – the materials it is made of, the processes that act on those materials, the products formed, and the history of the planet and its life forms since its origin" (USEPA, 2016a).
[84] Climate: "The average weather conditions in a particular location or region at a particular time of the year. Climate is usually measured over a period of 30 years or more" (USEPA, 2016a).
[85] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables" (USEPA, 2016a).
[86] Physiographic: "The natural, physical form of the landscape" (USEPA, 2016a).

These ecoregions support a variety of different plant communities; all predicated on their general location within the state. Within each ecoregion a variety of habitat types can be found. These habitat types are not only dependent on location within the state but are also largely dependent on elevation, soils, and water availability/influence. For example in the coast range habitat types include: sand dunes and grasses, riparian, old growth forests, coastal forests, cranberry bogs, estuaries, riparian areas, rainforests, and wetlands. Table 8.1.6-2 provides a summary of the general abiotic[87] characteristics, vegetative communities, and the typical vegetation found within each of Washington's ecoregions.

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

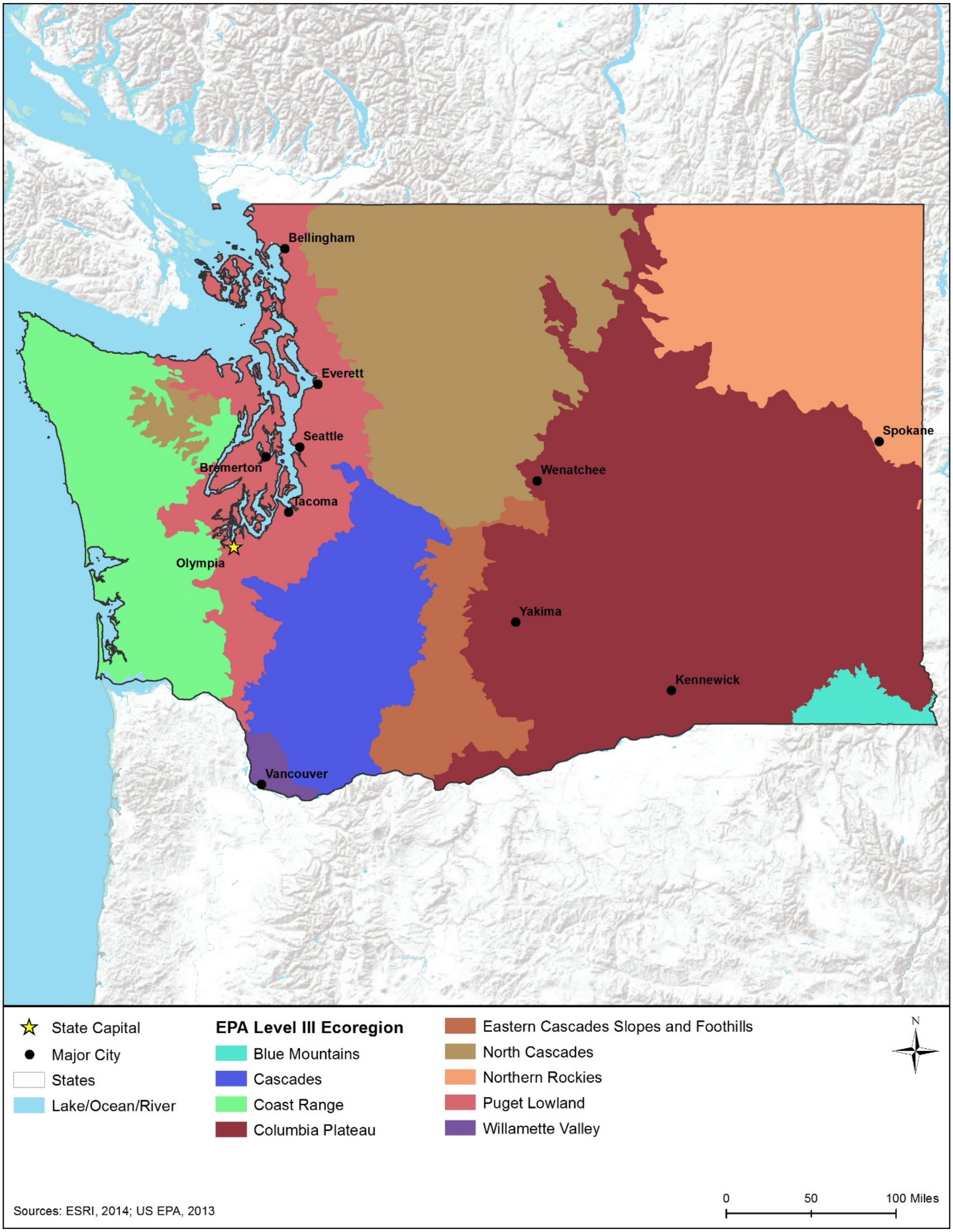


Figure 8.1.6-1: USEPA Level III Ecoregions in Washington

Table 8.1.6-2: USEPA Level III Ecoregions in Washington

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
Geographic Region: Coast				
1	Coast Range	Coastal lowlands consist of low gradient streams, tidal marshes and floats Coastal uplands consists of steeper gradients with medium and large streams.	Redwood forests, Douglas-fir/western hemlock forests, sand dunes, tidal flats, marshes.	**Hardwoods** – red alder (*Alnus rubra*), Oregon ash (*Fraxinus latifolia*) **Conifer Trees** – shore pine (*Pinus contorta*), Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), western red-cedar (*Thuja plicata*), Douglas-fir (*Pseudotsuga menziesii*) **Shrubs** – salal (*Gaultheria shallon*), evergreen huckleberry (*Vaccinium ovatum*), salmonberry (*Rubus spectabilis*)
Geographic Region: Puget Sound				
2	Puget Lowland	Wide low-lying area between the cascades and the Olympic mountains that sits on sand and gravel aggregate left behind by glaciers.	*Western Hemlock forest (~48%) Developed (~20%), Agriculture (~10%) Water (~10%) Others less than 5% each.	**Conifer Trees** - western hemlock, douglas-fir
Geographic Region: Willamette Valley				
3	Willamette Valley	The majority of this ecoregion has been altered by development; however, oak woodlands, grasslands, wetland, riparian areas, and aquatic habitats can all be found in fragmented habitats. "Mediterranean-like climate."	Fragmented habitats including grasslands, oak woodlands, riparian, and wetlands located on mountain foothills and floodplains.	**Hardwoods** – Oregon white oak (*Quercus garryana*), red alder, Oregon ash, bigleaf maple (*Acer macrophyllum*) **Conifer Trees** – douglas-fir, western red-cedar, western hemlock **Shrubs** – Willow species (*Salix* spp.), rose spirea (*Spiraea douglasii*), snowberry (*Symphoricarpos albus*). Invasives including Himalayan black-berry (*Rubus armeniacus*) and Reed canarygrass (*Phalaris arundinacea*) dominate in areas without trees
Geographic Region: The Cascades				
4	Cascades	Characterized by steep slopes with cool wet winters and warm dry summers. Fourteen volcanoes can be found within this ecoregion which largely influence soil development and habitat.	Douglas-fir/western hemlock forests, silver fir/red fir forests.	**Hardwoods** – red alder, cottonwood, bigleaf maple **Conifer Trees** – Douglas-fir, western hemlock, true firs (*Abies* spp.) **Shrubs** – vinemaple (*Acer circinatum*), redosier dogwood (*Cornus sericea*), salmonberry, stinkcurrent (*Ribes bracteosum*)

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
Geographic Region: East of the Cascades/Columbia Basin				
9	Eastern Cascades Slopes and Foothills	Varies greatly from cool and moist along the cascade border to dry and warm towards the east. Forested uplands, marshes, and agricultural fields characterize this ecoregion.	Mixed conifer, ponderosa pine, western juniper, grand fir, grasslands, and shrubland steepe.	**Hardwoods** – Mountain alder (*Alnus viridis*), water birch (*Betula occidentalis*) **Conifer Trees –** Grand fir (*Abies grandis*), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), western-red cedar, lodgepole pine (*Pinus contorta*) **Shrubs –** vinemaple. Douglas spiraea, redosier dogwood, snowberry
10	Columbia Plateau	Undulating hills and plateaus dissected by steep-sided canyons.	Ponderosa pine, western juniper, shrub steppe, grasslands.	**Hardwoods** – Water birch (*Betula occidentalis*), mountain alder (*Alnus viridis subsp. crispa*), hawthorn (*Crataegus*), black cottonwood (*Populus balsamifera subsp. trichocarpa*) **Conifer Trees** – lodgepole pine, western juniper (*Juniperus occidentalis*), ponderosa pine **Shrubs** – Douglas spirea, redosier dogwood, willow species, snowberry, big sagebrush (*Artemisia tridentata*)
11	Blue Mountains	Consists of a diverse complex of mountain ranges, valleys, steep river canyons, and plateaus, with habitats ranging from dry sagebrush steppe to high alpine peaks.	Habitats range from dry sagebrush steppe to high alpine peaks.	**Hardwoods** – Cottonwoods, white alder (*Alnus rhombifolia*) **Conifer Trees** – juniper, Engelmann spruce (*Picea engelmannii*), douglas-fir, lodgepole pine, white fir, and infrequent ponderosa pine and true fir. **Shrubs** – Pacific ninebark (*Physocarpus capitatus*), willow species, redosier dogwood, snowberry
Geographic Region: North Cascades				
77	North Cascades	Highly dissected, glaciated mountain terrain, with large volcanos. This ecoregion "contains the greatest concentration of active alpine glaciers in the 48 conterminous united states."	Forest habitats, grasslands, and aquatic habitats.	**Hardwoods** – Oregon white oak, California black oak (*Quercus kelloggii*), madrone (*Arbutus*), tanoak (*Notholithocarpus* species), Port orford cedar (*Chamaecyparis lawsoniana*) **Conifer Trees** – douglas-fir, incense cedar (*Calocedrus* species), ponderosa pine, Jeffery pine (*Pinus jeffreyi*) **Shrubs** – salal, evergreen huckleberry, salmonberry

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
Geographic Region: Oakanogan				
15	North Rockies	Climate varies extensively from west to east, with the western end experiencing the moderating effects of maritime influence and the eastern end experiencing a harsher, more continental regime. Climate varies from north to south, with local topographic change. Long, rounded ridges, rolling plateaus, wide valleys, and large lakes with the Thompson-Okanagan Plateau in the northeast and the Okanagan Highlands in the southeast characterize the ecoregion.	Ranges from alpine tundra to semi-arid shrub.	**Hardwoods –** Quaking aspen (*Populus tremuloides)* **Conifer Trees** - Whitebark pine (*Pinus albicaulis*), lodgepole pine, subalpine larch (*Larix lyallii*), Engleman spruce, subalpine fir, ponderosa pine, douglas-fir, western larch (*Larix occidentalis*), western white pine (*Pinus monticola*) **Shrubs –** huckleberry (*Vaccinium membranaceum*), Rhododendron (*Menziesia ferruginea*), alderleaf buckthorn (*Rhamnus alnifolia*), gooseberry (*Ribes lacustre*), thimbleberry (*Rubus parviflorus*), green alder (*Alnus viridis*), white rhododendron (*Rhododendron albiflorum*), mountain ash (*Sorbus scopulina* and *Sorbus sitchensis*), bilberry (*Vaccinium myrtillus*), and grouseberry (*Vaccinium scoparium*)

Sources: (Elias, 1989) (LandScope America, 2015) (Sorenson, 2015) (Petrides, 1973) (CEC, 2011)

Communities of Concern

Washington Department of Fish and Wildlife maintains a Priority Habitats and Species program that identifies habitats and species determined to be priorities based on defensible criteria and maintaining viable populations. The priority species are considered priorities for conservation and management by the State. In addition, the Washington State Department of Natural Resources, through the Natural Heritage Program (NHP) has identified several vegetative communities of concern that include rare natural plant communities, plant communities with vulnerability or sensitivity to disturbance, and communities that provide habitat for both 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 generated by the Proposed Action. This ranking system also provides an indication as to the level of potential impact a particular community could experience from an action.

Each natural community is assigned a priority rank based on its risk that the plant community may disappear. As with most state heritage programs, the WA NHP ranking system assesses rarity using two geographic scales - a global rank (G1, G2, G3, G4, G5) assigned by NatureServe, and a state rank (S1, S2, S3, S4, S5) assigned by the state (WNHP, 2011a). The global rank reflects the rarity of the community throughout its range, while the state rank indicates its rarity within the state of Washington. This rank is typically based on the range of the community, the number of occurrences, the viability of the occurrences, and the vulnerability of the community. NatureServe and NHP staff collect and evaluate data for species and ecosystems to ensure that assigned status ranks are accurate and consistent, based on current field and remote sensing information (NatureServe, 2016).

NHP has identified 86 key wildlife habitat types within 18 communities that represent rare natural communities for wildlife species (WNHP, 2011a). The distribution of habitat types is influenced by the diversity of Washington's nine major physiographic provinces. Washington Appendix B, Table B-1, summarizes the S-1 wildlife habitat types and communities found in Washington and associated USEPA Level III ecoregions.

Nuisance and Invasive Plants

There are a large number of undesirable plant species that are considered nuisance and invasive[88] plants that are non-native to areas with the potential to spread causing harm to the environment, local economy, and human health. Noxious weeds[89] are typically non-native species that have been introduced into an ecosystem inadvertently; however, on occasional native species can be considered a noxious weed. Noxious weeds greatly affect agricultural areas, forest management, natural, and other open areas (GPO, 2011). The U.S. government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S. Code [U.S.C.] 7701 *et seq.*). As of September 2014, 112 federally recognized noxious weed species have been catalogued in the United States (88 terrestrial, 19 aquatic, and 5 parasitic) (USDA, 2015b).

Washington annually adopts, by rule, a State Noxious Weed List, which determines which plants are considered noxious where they require control (on a county level). Once adopted, the state list is divided into county and district lists, based on plant distribution. There are three classes of noxious weeds on the state list: A, B, and C. (NWCB, 2010a)

- Class A includes non-native species that are limited in distribution in Washington. State law requires eradication of these plants (NWCB, 2010a). Examples include common cordgrass *(Spartina anglica)*, purple starthistle *(Centaurea calcitrapa)*, Texas blueweed *(Helianthus ciliaris)* (NWCB, 2010b).
- Class B includes non-native species that are limited in some areas of Washington, but abundant in other areas. The state encourages containment of these invasive plant species to prevent their spread. (NWCB, 2010a) Examples include common reed *(Phragmites australis)*, musk thistle (*Carduus nutans*), saltcedar (*Tamarix ramosissima*) (NWCB, 2010c).
- Class C includes non-native species that are found throughout the state. Counties are encouraged to enforce control of these plant species. (NWCB, 2010a) Examples include English ivy *(Hedera helix)*, Japanese eelgrass *(Zostera japonica)*, tree-of-heaven *(Ailanthus altissima)* (NWCB, 2010d).

[88] 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, 2016a).

County weed lists include all state Class A weeds and Class B weeds. Counties and districts can then select additional Class B weeds and Class C weeds that they will require control of in their area. (NWCB, 2010a)

The Washington Department of Agriculture Plant Protection Division, Plant Services Program maintains a list of plants and seeds whose transportation, distribution, and sales are prohibited in Washington state under WAC 16-752-600 through 660 (WSDA, 2014). Table 8.1.6-3 lists the prohibited weeds in Washington.

Table 8.1.6-3: Prohibited Weeds in Washington State

Scientific name	Common name
Abutilon theophrasti	velvetleaf
Alliaria petiolate	garlic mustard
Amorpha fruticose	indigobush, lead plant
Anchusa officinalis	common bugloss, alkanet, anchusa
Anthriscus sylvestris	wild chervil
Arundo donax (except variegated cultivars)	Giant reed
Brachypodium sylvaticum	false brome
Butomus umbellatus	flowering rush
Cabomba caroliniana	fanwort
Carduus acanthoides	plumeless thistle
Carduus nutans	musk thistle, nodding thistle
Carduus pycnocephalus	Italian thistle
Carduus tenuiflorus	slenderflower thistle
Centaurea calcitrapa	purple star thistle
Centaurea diffusa	diffuse knapweed
Centaurea jacea	brown knapweed, rayed knap- weed, brown centaury, horse- knobs, hardheads
Centaurea macrocephala	bighead knapweed
Centaurea nigra	black knapweed
Centaurea nigrescens	Vochin knapweed
Centaurea stoebe	spotted knapweed
Chaenorrhinum minus	dwarf snapdragon
Clematis orientalis	oriental clematis
Crassula helmsii	Australian swamp stonecrop
Crupina vulgaris	common crupina
Cyperus rotundus	purple nutsedge
Cytisus scoparius	scotch broom

Scientific name	Common name
Daucus carota	wild carrot, Queen Anne's lace
Echium vulgare	blueweed, blue thistle, blue devil, viper's bugloss, snake flower
Egaria densa	Brazilian elodea
Epilobium hirsutum	hairy willow herb
Euphorbia esula	leafy spurge
Euphorbia oblongata	eggleaf spurge
Galega officinalis	goatsrue
Genista monspessulana	French Broom
Geranium lucidum	shiny geranium
Glossostigma diandrum	mud mat
Glyceria maxima	reed sweetgrass, tall manna grass
Helianthus ciliaris	Texas blueweed
Heracleum mantegazzianum	Giant hogweed, giant cow parsnip
Hibiscus trionum	Venice mallow, flower-of-an- hour, bladder ketmia, modes- ty, shoo-fly
Hieracium aurantiacum	orange hawkweed, orange paintbrush, red daisy flame-weed, devil's weed, grim-the- collier
Hieracium caespitosum	yellow hawkweed, yellow paintbrush, devil's paintbrush, yellow devil, field hawkweed, king devil
Hieracium floribundum	yellow devil hawkweed
Hieracium pilosella	mouse ear hawkweed
Hieracium sabaudum	European hawkweed
Hydrilla verticillata	hydrilla
Hydrocharis morsus-ranae	European frog-bit
Impatiens glandulifera	policeman's helmet
Isatis tinctoria	dyers' woad
Kochia scoparia	kochia, summer-cyprus, burning-bush, fireball, Mexican fireweed
Lagarosiphon major	African elodea
Leucanthemum vulgare	oxeye daisy, white daisy, whiteweed, field daisy, marguerite, poorland flower
Linaria dalmatica spp. dalmatica	Dalmatian toadflax
Ludwigia hexapetala	water primrose
Ludwigia peploides	floating primrose-willow
Lysimachia vulgaris	garden loosestrife
Lythrum salicaria	purple loosestrife

Scientific name	Common name
Lythrum virgatum	wand loosestrife
Mirabilis nyctaginea	wild four o'clock, umbrella-wort
Murdannia keisak	Marsh dew flower, Asian spiderwort
Myriophyllum aquaticum	parrotfeather
Myriophyllum heterophyllum	variable-leaf milfoil
Myriophyllum spicatum	Eurasian watermilfoil
Najas minor	slender-leaved naiad, brittle naiad
Nymphoides peltata	yellow floating heart
Onopordum acanthium	Scotch thistle
Polygonum cuspidatum	Japanese knotweed
Polygonum polystachyum	Himalayan knotweed
Polygonum sachalinense	giant knotweed
Polygonum x bohemicum	Bohemian knotweed, Japanese and giant knotweed hybrid
Proboscidea louisianica	unicorn-plant
Pueraria montana var. lobata	kudzu
Sagittaria graminea	grass-leaved arrowhead
Sagittaria platyphylla	delta arrowhead
Salvia aethiopis	Mediterranean sage
Salvia pratensis	meadow clary
Salvia sclarea	clary sage
Schoenoplectus mucronatus	ricefield bulrush
Senecio jacobaea	tansy ragwort
Silybum marianum	milk thistle
Solanum elaeagnifolium	silverleaf nightshade
Solanum rostratum	buffaloburr
Soliva sessilis	lawnweed
Sorghum halepense	johnsongrass
Spartina alterniflora	smooth cordgrass
Spartina anglica	common cordgrass
Spartina densiflora	dense-flowered cordgrass
Spartina patens	salt meadow cordgrass
Spartium junceum	Spanish broom
Stratiotes aloides	water soldier
Tamarix ramosissima	saltcedar

Scientific name	Common name
Thymelaea passerina	spurge flax
Torilis arvensis	hedgeparsley
Trapa natans	water chestnut, bull nut
Trapa bicornus	water caltrap, devil's pod, bat nut
Ulex europaeus	gorse, furze
Utricularia inflata	swollen bladderwort
Zygophyllum fabago	Syrian bean-caper

8.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Washington, divided among mammals, birds, reptiles and amphibians, and invertebrates. Terrestrial wildlife are those species of animals, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals and furbearers,[90] nongame animals, and game birds, waterfowl, and their habitats found in Washington (University of Puget Sound, 2015a). A discussion of non-native or invasive wildlife species is also included.

Washington's landscape and climate is diverse across the state and offers a wide range of habitat to support both terrestrial and aquatic species. An estimated 651 wildlife species occur in Washington (O'Neil & Johnson, 2001). Of the species found in Washington, 268 are tracked by the WDFW's State Wildlife Action Plan (SWAP) as Species of Greatest Conservation Need (SGCN) (WDFW, 2015b).

Mammals

There are 105 native and 9 introduced species of mammals that can be found in the State of Washington, not including 27 marine mammal species (Burke Museum, 2013). Common mammals found in Washington include, but are not limited to, opossums (*Didelphis* spp.), shrews (*Sorex* spp.), moles (*Scapanus* spp., *Neurotrichus sp.*), bats (*Myotis* spp., *Parastrellus hesperus, Lasiurus cinereus, Lasionycteris noctivagans, Corynorhinus townsendii, Antrozous pallidus*), pikas (*Ochotona princeps*), hares and rabbits (*Sylvilagus* spp., *Lepus* spp., *Oryctolagus cuniculus, Brachylagus idahoensis*), mountain beaver (*Aplodontia rufa*), squirrels (*Sciurus* spp., *Tamiasciurus* spp., *Marmota* spp., *Urocitellus* spp., *Tamias* spp., *Glaucomys sabrinus*), pocket gophers (*Thomomys* spp.), heteromyidae rats (*Dipodomys ordii, Perognathus parvus*), beavers (*Castor canadensis*), cricetid voles (*Lemmiscus curtatus, Microtus* spp., *Clethrionomys gapperi, Phenacomys intermedius*), muskrats (*Ondatra zibethicus*), lemmings (*Synaptomys borealis*), murid rats (*Mus musculus, Rattus* spp.), jumping mice (*Zapus* spp.), porcupines (*Erethizon dorsatum*), nutrias (*Myocastor coypus*), coyotes (*Canis latrans*), wolves (*Canis lupus*), foxes (*Vulpes vulpes*), bears (*Ursus* spp.), raccoons (*Procyon lotor*), martens (*Martes americana*), fishers (*martes pennanti*), weasels and mink (*Mustela* spp.), wolverines (*Gulo gulo*), badgers (*Taxidea taxus*), skunks (*Mephitis mephitis, Spilogale gracilis*), otters (*Enhydra lutris, Lontra*

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

canadensis), cats *(Lynx* spp., *Puma concolor)*, elk (*Cervus ela[hus*), deer (*Odocoileus* spp.), moose (*Alces alces*), caribou (*Rangifer tarandus*), mountain goats (*Oreamnos americanus*), and bighorn sheep (*Ovis canadensis*). (Burke Museum, 2013).

There are 34 mammal species or species units (i.e., ESUs or DPSs) listed as SGCN in Washington, not including 10 marine mammal species. SGCN mammal species in Washington include rabbits (American Pika (*Ochotona princeps*), Black-tailed jackrabbit (*Lepus californicus*), Pygmy Rabbit (*Brachylagus idahoensis*), and White-tailed jackrabbit (*Lepus townsendii*)); shrews (Destruction Island shrew (*Sorex trowbridgii destructioni*), Merriam's shrew (*Sorex merriami*), and Preble's shrew (*Sorex preblei*)); bats (Hoary bat (*Lasiurus cinereus*), Keen's Myotis (*Myotis keenii*), Silver-haired bat (*Lasionycteris noctivagans*), Spotted bat (*Euderma maculatum*), and Townsend's big-eared bat (*Corynorhinus townsendii*)); rodents (Brush prairie pocket gopher (*Thomomys mazama ssp. douglasii*), Gray-tailed vole (*Microtus canicaudus*), Kincaid meadow vole (*Microtus pennsylvanicus kincaidi*), Mazama pocket gopher (*Thomomys mazama*), Northern bog lemming (*Synaptomys borealis*), Olympic marmot (*Marmota olympus*), Shaw island Townsend's vole (*Micrutus townsendii pugeti*), Townsend's ground squirrel (*Urocitellus townsendii*), Washington ground squirrel (*Urocitellus washingtoni*), and Western gray squirrel (*Sciurus griseus*)), terrestrial carnivores (American badger (*Taxidea taxus*), Pacific marten (*Martes caurina*), Cascade red fox (*Vulpes vulpes cascadensis*), fisher (*Martes pennanti*), Gray wolf (*Canis lupus*), Grizzly bear (*Ursus horriblis*), Lynx (*Felis lynx*), Western spotted skunk (*Spilogale gracilis*), and Wolverine (*Gulo gulo*)), and ungulates (Bighorn sheep (*Ovis canadensis*), Columbian white-tailed deer (*Odocoileus virginianus leucurus*), and Woodland caribou (*Rangifer tarandus caribou*)) (WDFW, 2015b). Marine mammals are discussed in Section 8.1.6.5. Threatened or endangered mammal species are discussed in section 8.1.6.6 *Threatened and Endangered Species and Species of Conservation Concern.*

Birds

More than 480 species have been recorded as occurring in Washington with 350 species residing or visiting regularly (Seattle Audubon Society, 2016) (McNair-Huff, 2004). This species richness is directly related to the diverse habitats occurring in Washington including Sitka spruce forests, rain forests, sandy beaches, shrub-steppe and grasslands, riparian areas, wetlands, and more. Examples of bird species found Washington include, but are not limited to, swans (*Cygnus* spp.), ducks (*Aix sponsa, Melanitta* spp., *Mergus* spp.), geese (*Anser* spp., *Branta* spp.), pheasants (*Alectoris chukar, Phasianus colchicus*), grouse (*Bonasa umbellus, Tympanuchus phasianellus*), quail (*Oreortyx pictus, Colinus virginianus*), turkey (*Meleagris gallopavo*), loons (*Gavia* spp.), grebes (*Podilymbus podiceps, Aechmophorus* spp.), albatross (*Phoebastria* spp.), petrels (*Fulmarus glacialis, Puffinus* spp., *Oceanodroma* spp.), pelicans (*Pelecanus* spp.), cormorants (*Phalacrocorax* spp.), bitterns (*Botaurus lentiginosus*), herons (*Ardea herodias*), ibises (*Plegadis chihi*), egrets (*Ardea alba, Bubulcus ibis*), osprey (*Pandion haliaetus*), hawks (*Elanus leucurus, Accipiter* spp.), falcons (*Falco* spp.), rails (*Rallus limicola, Fulica americana*), cranes (*Grus canadensis*), vultures (*Cathartes aura*), shorebirds (*Pluvialis* spp., *Phalaropus* spp., *Stercorarius* spp.), gulls (*Rissa tridactyla, Hydroprogne caspia*), terns (*Chlidonias niger, Sterna* spp.), doves (*Streptopelia decaocto, Zenaida macroura*), pigeons (*Columba livia, Patagioenas* *fasciata*), owls (*Tyto alba, Bubo* spp., *Aegolius* spp.), goatsuckers (*Phalaenoptilus nuttallii*), swifts (*Cypseloides niger*,), hummingbirds (*Selasphorus* spp.), kingfishers (*Megaceryle alcyon*), woodpeckers (*Melanerpes* spp., *Sphyrapicus* spp.), flycatchers (*Contopus* spp., *Empidonax* spp.), larks (*Eremophila alpestris*), vireos (*Vireo* spp.), shrikes (*Lanius* spp.), crows (*Nucifraga Columbiana*, *Corvus* spp.), jays (*Perisoreus canadensis*, *Cyanocitta* spp.), magpies (*Pica hudsonia*), swallows (*Tachycineta* spp., *Stelgidopteryx serripennis*), martins (*Progne subis*), chickadees (*Poecile* spp.), bushtits (*Psaltriparus minimus*), creepers (*Certhia americana*), nuthatches (*Sitta* spp.), wrens (*Salpinctes obsoletus, Troglodytes* spp.), dippers (*Cinclus mexicanus*), kinglets (*Regulus* spp.), thrushes (*Sialia* spp., *Catharus* spp.), mockingbirds (*Dumetella carolinensis, Mimus polyglottos*), starlings (*Sturnus vulgaris*), pipits (*Anthus rubescens*), waxwings (*Bombycilla* spp.), longspurs and snow buntings (*Calcarius lapponicus, Plectrophenax nivalis*), warblers (*Oreothlypis* spp.), tanagers (*Piranga ludoviciana*), towhee (*Pipilo* spp.), sparrows (*Spizella* spp., *Melospiza* spp., *Zonotrichia* spp., *Junco hyemalis*), buntings (*Passerina amoena*), blackbirds (*Agelaius* spp.), orioles (*Icterus bullockii*), finches (*Leucosticte tephrocotis*), grosbeaks (*Pheucticus melanocephalus*), and house sparrows (*Passer domesticus*) (Paulson, 2013).

Washington is located within the Pacific Flyway, which spans 5,000 miles in total, including 4,000 miles from the Arctic to the west coast of Mexico and 1,000 miles from the Rocky Mountains to the Pacific Ocean. At least one billion birds migrate along the pacific flyway and depend on diverse habitats such as arctic tundra, northwestern rainforest, tropical beaches, and mangroves. The most varied waterfowl habitats in North America are found in the Pacific Flyway (Ducks Unlimited, 2015). “The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, or purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations” (USFWS, 2013a). The USFWS is responsible for enforcing the MBTA and maintaining the list of protected species. The migratory bird species protected under the MBTA are listed in 50 CFR 10.13 (USFWS, 2013a).

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act. Bald eagles are generally found near large rivers and lakes in the entire state during the winter season (eBird, 2015a). Golden eagles are generally found in a variety of habitat types throughout their range, but they generally nest in mountains and cliffs. Golden eagles are found in the northwestern parts of the state during the winter season (eBird, 2015b).

There are 75 Important Bird Areas (IBA) have been identified in Washington, as can be seen in Figure 8.1.6-2 (Audubon Washington, 2015). IBAs are selected for their high habitat value and in Washington all four of the world’s major terrestrial biomes can be found including alpine, desert, grassland, and forest. IBAs represent both terrestrial and aquatic sites that are critically important to birds during breeding, wintering and migration (Audubon Washington, 2001). Washington began to identify IBA’s in 1998 with two primary goals 1) identify sites in the state of Washington that are most essential for long-term conservation of birds, and 2) to take action to ensure conservation of these sites (Audubon Washington, 2015).

There are 52 bird species listed as SGCN in Washington, including waterfowl (Barrow's Goldeneye (*Bucephala islandica*), Black Scoter (*Melanitta americana*), Cinnamon Teal (*Anas cyanoptera*), Dusky Canada Goose (*Branta canadensis occidentalis Baird*), Harlequin Duck (*Histrionicus histrionicus*), Long-tailed Duck (*Clangula hyemalis*), Surf Scoter (*Melanitta perspicillata*), White-winged Scoter (*Melanitta deglandi*), Western High Arctic Brant (*Branta bernicla*)); upland game birds (Greater Sage-grouse (*Centrocercus urophasianus*), Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus col*umbianus), Mountain Quail (*Oreortyx pictus*), Spruce Grouse (*Falcipennis canadensis*), White-tailed Ptarmigan (*Lagopus leucura*)); marine and waterbirds (American White Pelican (*Pelecanus erythrorhynchos*), Brown Pelican (*Pelecanus occidentalis*), Clark's Grebe (*Aechmophorus clarkii*), Common Loon (*Gavia immer*), Marbled Murrelet (*Brachyramphus marmoratus*), Red-necked Grebe (*Podiceps grisegena*), Short-tailed Albatross (*Phoebastria albatrus*), Tufted Puffin (*Fratercula cirrhata*), Western Grebe (*Aechmophorus occidentalis*)); falcons, hawks, and eagles (Bald eagle (*Haliaeetus leucocephalus*), Ferruginous Hawk (*Buteo regalis*), Golden Eagle (*Aquila chrysaetos*), Peregrine Falcon (*Falco peregrinus*)); cranes (Sandhill Crane (greater) (*Grus canadensis*)); shorebirds (Marbled Godwit (*Limosa fedoa*), Red Knot (*Calidris canutus*), Rock Sandpiper (*Calidris* or *Erolia ptilocnemis*), Upland Sandpiper (*Bartramia longicauda*), Western Snowy Plover (*Charadrius nivosus ssp. Nivosus*)); pigeons (Band-tailed Pigeon (*Patagioenas fasciata*)); cuckoos (Yellow-billed Cuckoo (*Coccyzus americanus*)); owls (Burrowing Owl (*Athene cunicularia*), Flammulated Owl (*Psiloscops flammeolus*), Great Gray Owl (*Strix nebulosa*), Northern Spotted Owl (*Strix occidentalis caurina*), Short-eared Owl (*Asio flammeus*), Western Screech Owl (*Megascops kennicottii*)); woodpeckers (Lewis' Woodpecker (*Melanerpes lewis*), White-headed Woodpecker (*Picoides albolarvatus*)); and perching birds (Loggerhead Shrike (*Lanius ludovicianus*), Oregon Vesper Sparrow (*Pooecetes gramineus affinis*), Purple Martin (*Progne subis*), Pygmy Nuthatch (*Sitta pygmaea*), Sage Thrasher (*Oreoscoptes montanus*), Sagebrush Sparrow (*Artemisiospiza nevadensis*), Slender-billed White-breasted Nuthatch (*Sitta carolinensis ssp. Aculeata*), Streaked Horned Lark (*Eremophila alpestris strigata*), Western Bluebird – Western Washington (*Sialia mexicana*)) (WDFW, 2015b).

The Endangered Species Act (ESA) protects several species of birds listed as threatened or endangered. Threatened and endangered bird species are discussed in section 8.1.6.6 Threatened and Endangered Species and Species of Concern.

Reptiles and Amphibians

An estimated 54 species of reptiles and amphibians can be found in Washington including 26 species of amphibians and 28 species of reptiles. Amphibians include salamanders (*Ambystoma* spp., *Dicamptodon* spp., *Ensatina eschscholtzii*, *Plethodon* spp., *Rhyacotriton* spp., *Taricha granulosa*) and frogs (*Ascaphus* spp., *Anaxyrus* spp., *Pseudacris regilla*, *Rana* spp., *Lithobates* spp., *Scaphiopus intermontanus*). Reptiles include turtles (*Chelydra serpentina*, *Chrysemys picta*, *Actinemys marmorata*), snakes (*Charina bottae*, *Coluber* spp., *Contia tenuis*, *Diadophis punctatus*, *Hypsiglena chlorophaea*, *Lampropeltis zonata*, *Pituophis catenifer*, *Thamnophis elegans*, *Crotalus oreganus*), and lizards (*Elgaria* spp., *Plestiodon skiltonianus*, *Phrynosoma douglassii*, *Sceloporus* spp., *Uta stansburiana*) (Burke Museum, 2015). Aquatic species, including marine reptiles, are discussed further in Section 8.1.6.5. Reptile and amphibian species occur in a wide variety of habitat throughout the state.

There are 14 amphibian species and 12 reptile species listed as SGCN in Washington. The SGCN amphibians in Washington include: salamanders (Tiger Salamander (*Ambystoma tigrinum*), Cope's Giant Salamander (*Dicamptodon copei*), Cascade Torrent Salamander (*Rhyacotriton cascadae*), Columbia Torrent Salamander (*Rhyacotriton kezeri*), Olympic Torrent Salamander (*Rhyacotriton olympicus*), Dunn's Salamander (*Plethodon dunni*), Larch Mountain Salamander (*Plethodon larselli*), Van Dyke's Salamander (*Plethodon vandykei*)); toads (*Western Toad (Anaxyrus boreas*), Woodhouse's Toad (*Anaxyrus woodhousii*)); and frogs (Rocky Mountain Tailed Frog (*Ascaphus montanus*), Columbia Spotted Frog (*Rana luteiventris*), Oregon Spotted Frog (*Rana pretiosa*), Northern Leopard Frog (*Lithobates pipiens*)). The SGCN reptiles in Washington include: turtles (Green Sea Turtle (*Chelonia mydas*), Leatherback Sea Turtle (*Dermochelys coriacea*), Loggerhead Sea Turtle (*Caretta caretta*), Western Pond Turtle (*Actinemys marmorata* or *Emys marmorata*)); lizards (Pygmy Horned Lizard (*Phrynosoma douglasii*), Sagebrush Lizard (*Sceloporus graciosus*), Side-blotched Lizard (*Uta stansburiana*)); and snakes (California Mountain Kingsnake (*Lampropeltis zonata*), Desert Nightsnake (*Hypsiglena chlorophaea*), Ring-necked Snake (*Diadophis punctatus*), Sharp-tailed Snake (*Contia tenuis*), Striped Whipsnake (*Masticophis taeniatus ornatus*)). (WDFW, 2015b) One amphibian species is threatened in Washington. Section 8.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

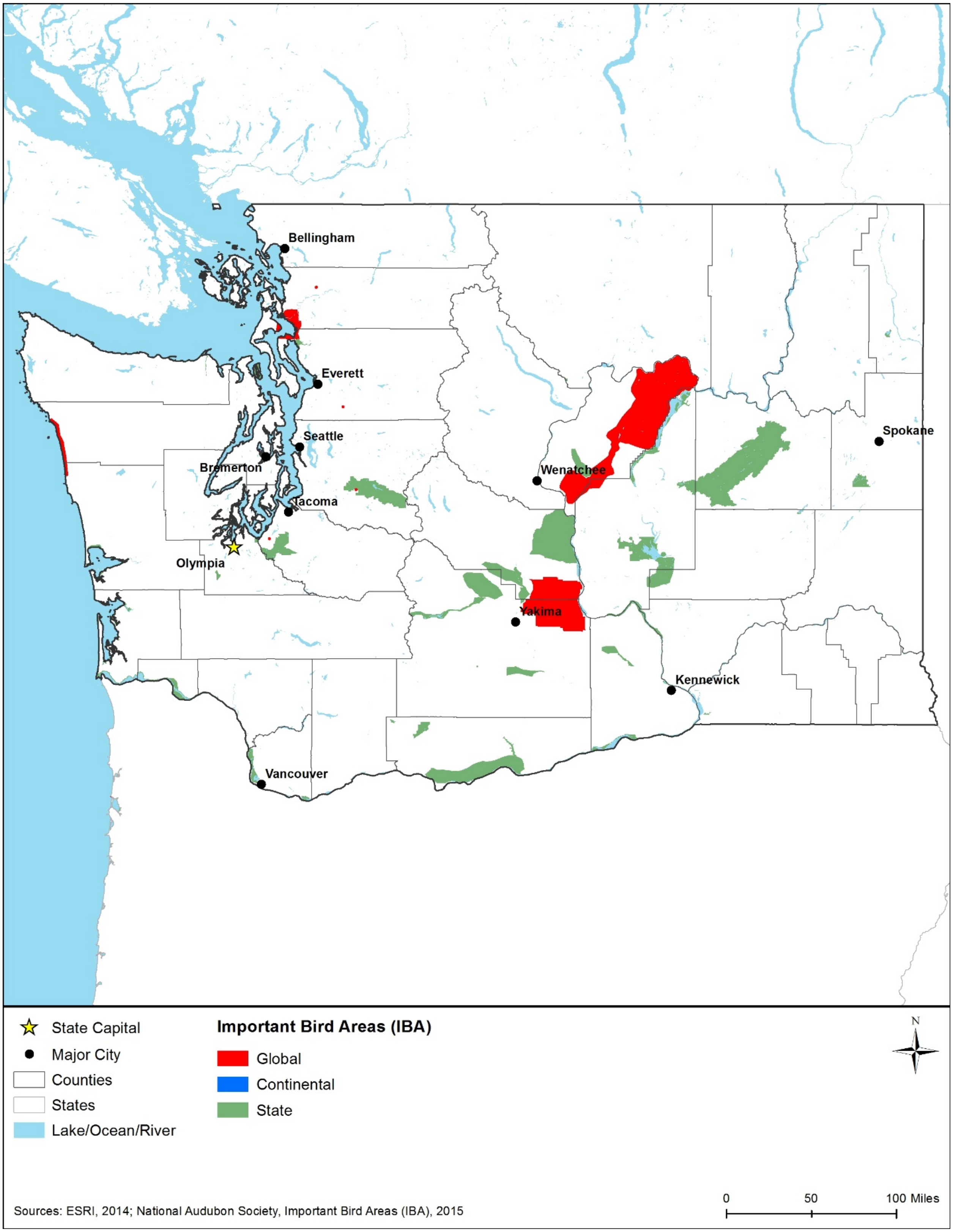


Figure 8.1.6-2: Important Bird Areas in Washington

Invertebrates

Washington is home to a large number (approximately 20,000) of invertebrate species including moths, butterflies, ladybugs, dragonflies, beetles, snails, worms, amphipods, freshwater mussels including sensitive species such as the floater mussels (California, Oregon, Western, and winged), and shore bugs (landscope.org, 2016). These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. In the U.S., one third of all agricultural output depends on pollinators[91] (NIH, 2009). In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity and plant diversity. Insect larvae inhabiting freshwater areas are often used to monitor the health of streams and wetlands; in Washington, mayfly, stonefly, and caddisfly richness is specifically used as an indicator of water quality (USDA, 2016).

One endangered invertebrate is located in Washington. Section 8.1.6.6 Threatened and Endangered Species and Species of Conservation Concern identifies these protected species.

Invasive Wildlife Species

The Washington Invasive Species Council (Council) evaluates over 700 invasive plant, aquatic, and wildlife species in and in close proximity to Washington. Of the 700 species evaluated, the Council has selected 50 priority species that pose the greatest threat to the state's environment, economy, and human health. The following eight terrestrial wildlife invasive species are considered priority species by the Council (Invasive Species Council, 2015):

- Bark-boring moths (Synanthedon scitula, S. myopaeformis, Enarmonia formosana),
- Exotic leafrollers (Ditula angustiorana, Acleris variegana, Hedya nubiferana, Pandemis cerasana, P. heparama, Archips podana, A. rosanus, Cacoecimorpha pronubana),
- Exotic apple fruit pests (*Rhagoletis pomonella*),
- Mediterranean snail (*Cernuella virgata*),
- Feral swine (*Sus scrofa*),
- Lymantriids (Lymantria dispar asiatica, L. dispar dispar, L. mathura, L. monacha),
- Nutria (Myocastor coypus), and
- Wood-boring beetles (Anoplophora chinensis, A. glabripennis).

Terrestrial and aquatic invasive plant species have been summarized in Table 8.1.6-3. Other aquatic invasive species are discussed in section 8.1.6.5.

8.1.6.5. Fisheries and Aquatic Habitats

This section discusses the aquatic wildlife species in Washington, including fish, invertebrates, marine mammals, and sea turtles. A summary of non-native and invasive aquatic species is also presented in this section. Fish are divided into freshwater and saltwater species, although many of Washington's fish are diadromous (i.e., anadromous[92] and catadromous[93]), reflecting the state's location along the Pacific coast and the variety of aquatic habitats that it provides.

[91] Pollinators: "Animals or insects that transfer pollen from plant to plant" (USEPA, 2016a).
[92] Anadromous: "Referring to the lifecycle of fishes, such as salmon, in which adults travel upriver from the sea to breed, usually returning to the area where they were born" (USEPA, 2016a).
[93] Catadromous: "An organism which lives in fresh water and goes to the sea to spawn, such as some eels" (USEPA, 2016a).

Freshwater Fish

Many native freshwater fish can be found in Washington in a diversity of habitats from desert springs small mountain streams and large tidal rivers. These species are grouped into a variety of families, including: lampreys, sturgeons, herrings, cyprinidae, suckers, catfishes, smelt, trout and salmon, mudminnows, pickerels, loaches, killfishes, livebearers, cods, sticklebacks, troutperches, temperate basses, sunfishes, surfperches, perches, sculpins, and righteye flounders. A brief description of those families that contain common species is listed below.

Examples of lamprey found in Washington include the Pacific lamprey (*Lampetra tridentate),* the River lamprey (*L. ayresi),* and Western brook lamprey *(L. richardsoni*). The Pacific and River lampreys are anadromous. (University of Puget Sound, 2015b)

Sturgeon found in Washington include the Green sturgeon (*Acipenser medirostris*) and White sturgeon (*Acipenser transmontanus*). The white sturgeon is anadromou. (University of Puget Sound, 2015b)

The herring found in Washington is the American Shad (*Alosa sapidissima*), which is anadromous, and is found in the Columbia, Snake, Chehalis, and Willapa River drainages (University of Puget Sound, 2015b).

Examples of cyprinidae found in Washington include the Chiselmouth (*Acrocheilus alutaceus*) in rivers east of Cascades; Goldfish (*Carassius auratus*), established in lakes and scattered private ponds across state; Lake Chub (*Couesius plumbeus*) in northeastern lakes and streams; Grass Carp (*Ctenopharyngodon idella*), which are widely stocked in ponds and lakes; Common Carp (*Cyprinus carpio*), which are widespread in lakes and slow rivers; Tui Chub (*Gila bicolor*) found in lakes, ponds, and slow streams of Lower Crab Creek drainage, Columbia Basin; Peamouth (*Mylocheilus caurinus*) that are widespread in lakes and streams; Golden Shiner (*Notemigonus crysoleucas*) that are established in single lakes in Whatcom and Kitsap Counties; Fathead Minnow (Pimephales promelas), established locally across state; Northern Pikeminnow *(Ptychocheilus oregonensis*), which is widespread in slow streams, rivers, and lakes; Longnose Dace (*Rhinichthys cataractae*), which is widespread in swift streams; Leopard Dace (*Rhinichthys falcatus*) in slow streams of upper Columbia River drainage; Umatilla Dace (*Rhinichthys Umatilla*) of the rivers of upper Columbia River drainage; Speckled Dace (Rhinichthys osculus) that are widespread in streams; Redside Shiner (*Richardsonius balteatus*) that are widespread in streams and lakes; and Tench (*Tinca tinca*) found in local in lakes and ponds, Columbia and Spokane River drainages and Lower Washington (University of Puget Sound, 2015b).

Suckers found in Washington include the Longnose Sucker (*Catostomus catostomus*) in rivers and lakes east of Cascades; Salish Sucker (*Catostomus catostomus*) in rivers and streams in Puget Sound drainage; Bridgelip Sucker (*Catostomus columbianus*) in slow rivers of Columbia River drainage; Largescale Sucker (*Catostomus macrocheilus*), which is widespread in lakes and streams; and Mountain Sucker (*Catostomus platyrhynchus*) found in mountain streams of Columbia River drainage (University of Puget Sound, 2015b).

Catfishes found in Washington include Black Bullhead (*Ameiurus melas*) in scattered lakes and ponds in Columbia River drainage; Yellow Bullhead (*Ameiurus natalis*) also scattered lakes and ponds in Columbia River drainage; Brown Bullhead (Ameiurus nebulosus) that are widespread in lakes and ponds; Channel Catfish (*Ictalurus punctatus*) in lakes and streams of Columbia River drainage and a few in Puget Sound drainage; Tadpole Madtom (*Noturus gyrinus*) in the Snake River drainage east of Cascades; and Flathead Catfish (*Pylodictis olivaris*) in the Columbia River and tributaries (University of Puget Sound, 2015b).

Smelt found in Washington include Longfin Smelt (*Spirinchus thaleichthys*) in the Puget Sound drainage and Lower Washington and Eulachon (*Thaleichthys pacificus*) along the coast and lower Columbia River drainages; both are anadromous (University of Puget Sound, 2015b).

Trout and salmon found in Washington include Lake Whitefish (*Coregonus clupeaformis*) in the lakes of the Columbia River system in northeast Washington; Pygmy Whitefish (*Prosopium coulteri*) that are present in a few lakes across state; Mountain Whitefish (*Prosopium williamsoni*) that are widespread, large streams and lakes; Golden Trout (*Oncorhynchus aguabonita*) introduced from California into small high mountain lakes of the Skykomish River system; Cutthroat Trout (*Oncorhynchus clarki*), which are anadromous and appear west of Cascades, resident populations in the northeast, and introduced widely elsewhere; Pink Salmon (*Oncorhynchus gorbuscha*), Chum Salmon (*Oncorhynchus keta*), and Coho Salmon (*Oncorhynchus kisutch*), which are anadromous and appear along the coast and Puget Sound drainages;, which are anadromous, coast and Puget Sound drainages; Rainbow Trout (Steelhead) (*Oncorhynchus mykiss*), which are freshwater and anadromous, and are widespread; Sockeye Salmon (*Oncorhynchus nerka*), which are anadromous, and appear along the coast, Puget Sound and Columbia River drainages, as well as landlocked populations (“kokanee”) introduced widely; Chinook Salmon (*Oncorhynchus tshawytscha*) which are anadromous, and appear along the coast, Puget Sound and Columbia River; Atlantic Salmon (*Salmo salar*), many of which escape from fish-farming pens in both salt and fresh water and may become established; Brown Trout (*Salmo trutta*) in the Columbia River and a few lakes east of Cascades; Bull Trout (*Salvelinus confluentus*) that are widespread, in streams and lakes; Dolly Varden (*Salvelinus malma*), which are mostly anadromous and appear along the northwest coast; Brook Trout (*Salvelinus fontinalis*) that are widespread, in streams and lakes in mountains and the northeast; Lake Trout (*Salvelinus namaycush*) found in a few lakes, the northeast and Snohomish County; Arctic Grayling (*Thymallus arcticus*) found in a single mountain lake (University of Puget Sound, 2015b).

The Olympic mudminnow (*Novumbra hubbsi*) is a mudminnow found in from the Quinault to Chehalis River drainages and has introduced populations north to King county (University of Puget Sound, 2015b).

Pickerals found in Washington include Grass Pickerel (*Esox americanus*) found in a few lakes in the east; Northern Pike (*Esox Lucius*) whose Idaho populations have reached Spokane River in Washington; and the Tiger Muskellunge (*Esox lucius x Esox masquinongy*) that are widely stocked in lakes (University of Puget Sound, 2015b).

The Oriental Weatherfish (*Misgurnus anguillicaudatus*) is a Loach established in Lower Washington (University of Puget Sound, 2015b).

The following killifishes, livebarers, and cods are found in Washington, which include Banded Killifish (*Fundulus diaphanous*), Mosquitofish (*Gambusia affinis*), and Burbot (*Lota lota*), respectively (University of Puget Sound, 2015b).

Sticklebacks found in Washington include the Three-spine Stickleback (*Gasterosteus aculeatus*) that is widespread in lakes and streams, west of Cascades and lower Columbia River drainage and the Brook Stickleback (*Culaea inconstans*) found in the Rock Creek drainage in Spokane County (University of Puget Sound, 2015b).

The Sand Roller (*Percopsis transmontana*) troutperch in found in quiet backwaters and the Columbia River drainage in Washington (University of Puget Sound, 2015b).

The Striped Bass (*Morone saxatilis*) is a scarce temperate bass that is marine and up larger rivers in Washington (University of Puget Sound, 2015b).

Sunfishes found in Washington include the Rock Bass (*Ambloplites rupestris*) and found in a few lakes west of the Cascades; the Green Sunfish (*Lepomis cyanellus*) found in a few lakes near Spokane; the Pumpkinseed (*Lepomis gibbosus*), which are widespread and found in lakes; Warmouth (*Lepomis gulosus*), found in a few lakes, mostly in the west; Bluegill (*Lepomis macrochirus*), which is widespread, and found in lakes; Smallmouth Bass (*Micropterus dolomieu*) and Largemouth Bass (*Micropterus salmoides*), which are widespread, and found in lakes and streams; White Crappie (*Pomoxis annularis*) found in the lakes of Columbia and Snake River drainages; and Black Crappie (*Pomoxis nigromaculatus*), which is Widespread and found in lakes and large streams (University of Puget Sound, 2015b).

The Shiner Perch (*Cymatogaster aggregate*) is a surfperch that is marine and found occasionally in coastal rivers. The Yellow Perch (*Perca flavescens*) and Walleye (*Stizostedion vitreum*) are perch found in Washington (University of Puget Sound, 2015b).

The sculpins found in Washington include Coastrange Sculpin (*Cottus aleuticus*) found west of the Cascades in streams; Prickly Sculpin (*Cottus asper*), which is widespread and in streams; Mottled Sculpin (*Cottus bairdi*) found in the Upper Columbia River drainage and in streams; the Paiute Sculpin (*Cottus beldingi*) and Slimy Sculpin (*Cottus cognatus*), both found east of the Cascades and in streams; Shorthead Sculpin (Cottus confuses), which is widespread in the north and west and in streams; the Riffle Sculpin (*Cottus gulosus*) and Reticulate Sculpin (*Cottus perplexus*) found west of the Cascades and in streams; Margined Sculpin (*Cottus marginatus*) in the Blue Mountains and in streams; Torrent Sculpin (*Cottus rhotheus*), which is widespread and in streams; and Pacific Staghorn Sculpin (*Leptocottus armatus*), which is marine and also found in the mouths of coastal rivers (University of Puget Sound, 2015b).

The Starry Flounder (*Platichthys stellatus*) is a Righteye flounder that is marine, but occasionally found in coastal rivers (University of Puget Sound, 2015b).

There are 10 freshwater fish species listed as SGCN in Washington, including: Burbot (*Lota lota*), Lake chub (*Couesius plumbeus*), Tui Chub (*Gila bicolor*), Leopard Dace (*Rhinichthys falcatus*), Umatilla Dace (*Rhinichthys umatilla*), Olympic Mudminnow (*Novumbra hubbsi*), Margined Sculpin (*Cottus marginatus*), Mountain Sucker (*Catostomus platyrhynchus*), Salish Sucker (*Catostomus sp. cf. catostomus),* Pygmy Whitefish (*Prosopium coulterii*) (WDFW, 2015b). Sportfishing freshwater species are provided in Table 8.1.6-5. Threatened and Endangered *species* are discussed in section 8.1.6.6 Threatened and Endangered Species and Species of Concern.

Saltwater Fish

The offshore waters of Washington are home to a variety of marine fish that occupy a variety of habitats including those that are bottom dwelling, intertidal, nearshore, deeper waters, still deep waters, estuarine, pelagic, epipelagic, mesopelagic, bathypelagic, oceanic, and anadromous. Examples of marine species include, but are not limited to, hagfishes (*Eptatretus* spp.), lampreys (*Lampetra* spp.), cow sharks (*Hexanchus griseus, Notorynchus cepedianus*), dogfish sharks (*Somniosus pacificus, Squalis acanthias*), thresher sharks (*Alopias vulpinus*), basking sharks (*Cetorhinus maximus*), mackerel sharks (*Carcharodon carcharias, Lamna ditropis*), cat sharks (*Apristurus brunneus*), smoothhounds (*Galeorhinus galeus*), requiem sharks (*Prionace glauca*), angel sharks (*Squatina californica*), skates (*Bathyraja* spp., *Raja* spp.), electric rays (*Torpedo californica*), chimeras (*Hydrolagus colliei*), sturgeons (*Acipenser* spp.), pike congers (*Xenomystax atrarius*), duckbill (*Venefica sp.*), snipe eels (*Avocettinops infans*, *Nemichthys scolopaceus*), spiny eels (*Polyacanthonotus challengeri*), herrings (*Alosa sapidissima, Sardinops sagax*), anchovies (*Engraulis mordax*), carp (*Cyprinus carpio*), argentines (*Nansenia* spp.), deepsea smelts (*Bathylagus* spp.), spookfishes (*Bathylychnops exilis, Macropinna microstoma*), slickheads (*Alepocephalus tenebrosus, Talismania bifurcata*), tubeshoulders (*Holtbyrnia latifrons, Maulisia argipalla*), smelts (*Allosmerus elongates, Thaleichthys pacificus*), trouts and salmon (*Oncorhynchus* spp., *Salvelinus malma*), bristlemouths (*Cyclothone* spp.), hatchetfishes (*Argyropelecus* spp, *Sternoptyx pseudobscura*), viperfishes (*Chauliodus macouni*), dragonfishes (*Bathophilus flemingi, Opostomias mitsuii*), loosejaws (*Aristostomias scintillans*), pearleyes (*Benthalbella dentata*), paperbones (*Scopelosaurus harryi*), lizardfishes (*Synodus lucioceps*), barracudinas (*Lestidiops ringens, Notolepis rissoi*), daggertooths (*Anotopterus pharao*), lancetfishes (*Alepisaurus ferox*), laternfishes (*Protomyctophum* spp), moras (*Antimora microlepis*), melanonids (*Melanonus zugmayeri*), cods (*Gadus microcephalus, Microgadus proximus*), hakes (*Merluccius productus*), greenadiers (*Albatrossia pectoralis, Coryphaenoides* spp., *Nezumia stelgidolepis*), cusk-eels (*Chilara taylori*), livebearing brotulas (*Brosmophycis marginata*), toadfishes (*Porichthys notatus*), dreamers (*Bertella idiomorpha, Oneirodes* spp.), clingfishes (*Gobiesox maeandricus, Rimicola muscarum*), sauries (*Cololabis saira*), killifishes (*Cyprinodon variegatus*), silversides (*Atherinops affinis*), ribbonfishes (*Trachipterus altivelis*), spinyfins (*Diretmus argenteus*), bigscales (*Melamphaes lugubris*), barbourisiids (*Barbourisia rufa*), flabby whalefishes (*Gyrinomimus sp.*), oreos (*Allocyttus folletti*), tubesnouts (*Aulorhynchus flavidus*), sticklebacks (*Gasterosteus aculeatus*), pipefishes (*Syngnathus leptorhynchus*), scorpionfishes and rockfishes (*Sebastes* spp., *Sebastolobus* spp.), sablefishes and skilfishes (*Anoplopoma fimbria, Erilepis zonifer*), greenlings and lingcods (*Hexagrammos* spp., *Ophiodon elongatus*), combfishes (*Zaniolepis latipinnis*), sculpins (*Artedius* spp., *Zesticelus profundorum*), poachers (*Agonomalus mozinoi*), snailfishes (*Acantholiparis opercularis, Rhinoliparis* spp.), temperate basses (*Morone saxatilis*), sea bass (*Paralabrax clathratus*), tilefish (*Caulolatilus princeps*), jacks and pompanos (*Naucrates doctor Trachurus symmetricus*), dolphinfishes (*Coryphaena hippurus*), manefishes (*Caristius macropus*), croakers (*Atractosion* *nobilis*), sea chubs (*Medialuna californiensis*), barracudas (*Sphyraena argentea*), ronquils (*Rathbunella hypoplecta*), eelpouts (*Bothrocara* spp., *Taranetzella lycoderma*), pricklebacks (*Allolumpenus hypochromus*), wrymouths (*Delolepis gigantean*), gunnels (*Apodichthys flavidus, Pholis* spp., *Xererpes fucorum*), wolfish (*Anarrhichthys ocellatus*), quillfish (*Ptilichthys goodei*), prowfish (*Zaprora silenus*), graveldiggers (*Scytalina cerdale*), sandfish (*Trichodon trichodon*), kelpfish (*Gibbonsia* spp., *Heterostichus rostratus*), ragfish (*Icosteus aenigmaticus*), sand lances (*Ammodytes hexapterus*), gobies (*Clevelandia ios, Lepidogobius lepidus*), cutlassfishes (*Aphanopus carbo, Benthodesmus elongatus*), mackerels and tunas (*Euthynnus pelamis, Thunnus* spp.), swordfish (*Xiphias gladius*), louvar (*Luvarus imperialis*), medusafish (*Icichthys lockingtoni*), squaretails (*Tetragonurus cuvieri*), butterfish (*Peprilus simillimus*), lefteye flounders (*Citharichthys* spp., *Paralichthys californicus*), righteye flounders (*Atheresthes stomias, Reinhardtius hippoglossoides*), tonguefish (*Symphurus atricauda*), triggerfish (*Balistes polylepis*), and molas (*Mola mola*) (University of Puget Sound, 2016). Table 8.1.6-4 lists the fish saltwater families and associated species found in Washington.

Table 8.1.6-4: Saltwater Fish Families and Species of Washington

Marine Fish Family	Marine Fish Species
Hagfishes	Black hagfish (*Eptatretus deani*)
	Pacific hagfish (*Eptatretus stoutii*)
Lampreys	River lamprey (*Lampetra ayresii*) - anadromous
	Pacific lamprey (*Lampetra tridentate*) - anadromous
Cow Sharks	Sixgill shark (*Hexanchus griseus*)
	Sevengill shark (*Notorynchus cepedianus*)
Dogfish Sharks	Pacific sleeper shark (*Somniosus pacificus*)
	Spiny dogfish (*Squalus acanthias*)
Thresher Sharks	Common thresher (*Alopias vulpinus*)
Basking Sharks	Basking shark (*Cetorhinus maximus*)
Mackerel Sharks	White shark (*Carcharodon carcharias*)
	Bonito shark (*Isurus oxyrinchus*)
	Salmon shark (*Lamna ditropis*)
Cat Sharks	Brown cat shark (*Apristurus brunneus*)
Smoothhounds	Soupfin shark (*Galeorhinus galeus*)
Requiem Sharks	Blue shark (*Prionace glauca*)
Angel Sharks	Pacific angel shark (*Squatina californica*)
Skates	Sandpaper skate (*Bathyraja kincaidii*)
	Black skate (*Bathyraja trachura*)
	Deepsea skate (*Bathyraja abyssicola*)
	Flathead skate (*Bathyraja rosispinis*)
	Skate (*Bathyraja sp. A*)
	Big skate (*Raja binoculata*)
	California skate (*Raja inornata*)
	Longnose skate (*Raja rhina*)
	Starry skate (*Raja stellulata*)

Marine Fish Family	**Marine Fish Species**
	Skate (*Raja sp.*)
Electric Rays	Pacific electric ray (*Torpedo californica*)
Chimeras	Spotted ratfish (*Hydrolagus colliei*)
Sturgeons	Green sturgeon (*Acipenser medirostris*) - anadromous
	White sturgeon (*Acipenser transmontanus*) - anadromous
Pike Congers	Twin-pored eel (*Xenomystax atrarius*)
Duckbill Eels	Duckbill eel (*Venefica sp.*)
Snipe Eels	Blackline snipe eel (*Avocettinops infans*)
	Slender snipe eel (*Nemichthys scolopaceus*)
Spiny Eels	Longnose tapirfish (*Polyacanthonotus challenger*)
Herrings	American shad (*Alosa sapidissima*) - anadromous
	Pacific herring (*Clupea pallasii*)
	Pacific sardine (*Sardinops sagax*)
Anchovies	Northern anchovy (*Engraulis mordax*)
Minnows and Carps	Common carp (*Cyprinus carpio*)
Argentines	Bluethroat argentine (*Nansenia candida*)
	Stout argentine (*Nansenia crassa*)
Deepsea Smelts	Robust blacksmelt (*Bathylagus milleri*)
	Popeye blacksmelt (*Bathylagus ochotensis*)
	Pacific blacksmelt (*Bathylagus pacificus*)
Spookfishes	Javelin spookfish (*Bathylychnops exilis*)
	Barreleye (*Macropinna microstoma*)
Slickheads	California slickhead (*Alepocephalus tenebrosus*)
	Slickhead (*Bathylaco nigricans*)
	Slickhead (*Ericara salmoneum*)
	Slickhead (*Narcetes stomias*)
	Slickhead (*Talismania bifurcate*)
Tubeshoulders	Tubeshoulder (*Holtbyrnia latifrons*)
	Tubeshoulder (*Maulisia argipalla*)
	Shining tubeshoulder (*Sagamichthys abei*)
Smelts	Whitebait smelt (*Allosmerus elongates*)
	Surf smelt (*Hypomesus pretiosus*)
	Capelin (*Mallotus villosus*)
	Night smelt (*Spirinchus starksi*)
	Longfin smelt (*Spirinchus thaleichthys*) - anadromous
	Eulachon (*Thaleichthys pacificus*) - anadromous
Trouts and Salmons	Pink salmon (*Oncorhynchus gorbuscha*) - anadromous
	Chum salmon (*Oncorhynchus keta*) - anadromous
	Coho (silver) salmon (*Oncorhynchus kisutch*) - anadromous
	Sockeye (red) salmon (*Oncorhynchus nerka*) - anadromous
	Chinook (king) salmon (*Oncorhynchus tshawytscha*) - anadromous

Marine Fish Family	Marine Fish Species
	Cutthroat trout (*Oncorhynchus clarkia*) - anadromous
	Steelhead (*Oncorhynchus mykiss*) - anadromous
	Dolly varden (*Salvelinus malma*) - anadromous
	Atlantic salmon (*Salmo salar*)
Bristlemouths	Bristlemouth (*Cyclothone atraria*)
	Bristlemouth (*Cyclothone pallida*)
	Bristlemouth (*Cyclothone pseudopallida*)
	Bristlemouth (*Cyclothone signata*)
Hatchetfishes	Spurred hatchetfish (*Argyropelecus hemigymnus*)
	Silver hatchetfish (*Argyropelecus lychnus*)
	Bottlelights (*Danaphos oculatus*)
	Hatchetfish (Sternoptyx pseudobscura)
Viperfishes	Pacific viperfish (*Chauliodus macouni*)
Scaleless Black Dragonfishes	Highfin dragonfish (*Bathophilus flemingi*)
	Pitgum dragonfish (*Opostomias mitsuii*)
	Longfin dragonfish (*Tactostoma macropus*)
Loosejaws	Shiny loosejaw (*Aristostomias scintillans*)
Pearleyes	Northern pearleye (*Benthalbella dentate*)
Paperbones	Scaly paperbone (*Scopelosaurus harryi*)
Lizardfishes	California lizardfish (*Synodus lucioceps*)
Barracudinas	Slender barracudina (*Lestidiops ringens*)
	Ribbon barracudina (*Notolepis rissoi*)
	Duckbill barracudina (*Paralepis atlantica*)
Daggertooths	Daggertooth (*Anotopterus pharaoh*)
Lancetfishes	Longnose lancetfish (*Alepisaurus ferox*)
Lanternfishes	California flashlightfish (*Protomyctophum crockery*)
	No. flashlightfish (*Protomyctophum thompsoni*)
	Calif. Lanternfish (*Symbolophorus californiensis*)
	Blue lanternfish (*Tarletonbeania crenularis*)
	Dogtooth lampfish (*Ceratoscopelus townsendi*)
	Sunbeam lampfish (*Lampadena urophaos*)
	Lampfish (*Lampanyctus jordani*)
	Pinpoint lampfish (*Lampanyctus regalis*)
	Broadfin lampfish (*Lampanyctus ritteri*)
	Northern lanternfish (*Stenobrachius leucopsarus*)
	California headlightfish (*Diaphus theta*)
	Patchwork lampfish (*Notoscopelus resplendens*)
Moras	Pacific flatnose (*Antimora microlepis*)
Melanonids	Arrowtail (*Melanonus zugmayeri*)
Cods	Pacific cod (*Gadus microcephalus*)
	Pacific tomcod (*Microgadus proximus*)
	Walleye Pollock (*Theragra chalcogramma*)

Marine Fish Family	Marine Fish Species
Hakes	Pacific hake (whiting) (*Merluccius productus*)
Grenadiers	Giant grenadier (*Albatrossia pectoralis*)
	Pacific grenadier (*Coryphaenoides arcolepis*)
	Grenadier (*Coryphaenoides armatus*)
	Grenadier (*Coryphaenoides cinereus*)
	Threadfin grenadier (*Coryphaenoides filifer*)
	Ghostly grenadier (*Coryphaenoides leptolepis*)
	Grenadier (*Nezumia stelgidolepis*)
Cusk-Eels	Spotted cusk-eel (*Chilara taylori*)
	Cusk-eel (*Spectrunculus grandis*)
Livebearing Brotulas	Red brotula (*Brosmophycis marginata*)
Toadfishes	Plainfin midshipman (*Porichthys notatus*)
Dreamers	Dreamer (*Bertella idiomorpha*)
	Dreamer (*Chaenophryne melanorhabdus*)
	Dreamer (*Oneirodes bulbosus*)
	Dreamer (*Oneirodes thompsoni*)
Clingfishes	Northern clingfish (*Gobiesox maeandricus*)
	Kelp clingfish (*Rimicola muscarum*)
Sauries	Pacific saury (*Cololabis saira*)
Killifishes	Sheepshead minnow (*Cyprinodon variegatus*)
Silversides	Topsmelt (*Atherinops affinis*)
Opahs	Opah (*Lampris guttatus*)
Ribbonfishes	King-of-the-salmon (*Trachipterus altivelis*)
Spinyfins	Spinyfin (*Diretmus argenteus*)
Bigscales	Highsnout bigscale (*Melamphaes lugubris*)
	Crested bigscale (*Poromitra crassiceps*)
	Bigscale (*Scopeloberyx robustus*)
Barbourisiids	Barbourisiid (*Barbourisia rufa*)
Flabby Whalefishes	Flabby whalefish (*Gyrinomimus sp.)*
Oreos	Oxeye oreo (*Allocyttus folletti*)
Tubesnouts	Tubesnout (*Aulorhynchus flavidus*)
Sticklebacks	Three-spined stickleback (*Gasterosteus aculeatus*) - anadromous
Pipefishes and Seahorses	Bay pipefish (*Syngnathus leptorhynchus*)
Scorpionfishes and Rockfishes	Rougheye rockfish (*Sebastes aleutianus*)
	Pacific ocean perch (*Sebastes alutus*)
	Brown rockfish (*Sebastes auriculatus*)
	Aurora rockfish (*Sebastes aurora*)
	Redbanded rockfish (*Sebastes babcocki*)
	Shortraker rockfish (*Sebastes borealis*)
	Silvergray rockfish (*Sebastes brevispinis*)
	Copper rockfish (*Sebastes caurinus*)
	Greenspotted rockfish (*Sebastes chlorostictus*)

Marine Fish Family	Marine Fish Species
	Darkblotched rockfish (*Sebastes crameri*)
	Splitnose rockfish (*Sebastes diploproa*)
	Greenstriped rockfish (*Sebastes elongates*)
	Puget Sound rockfish (*Sebastes emphaeus*)
	Widow rockfish (*Sebastes entomelas*)
	Yellowtail rockfish (*Sebastes flavidus*)
	Chilipepper (*Sebastes goodie*)
	Rosethorn rockfish (*Sebastes helvomaculatus*)
	Shortbelly rockfish (*Sebastes jordani*)
	Quillback rockfish (*Sebastes maliger*)
	Black rockfish (*Sebastes melanops*)
	Blackgill rockfish (*Sebastes melanostomus*)
	Vermillion rockfish (*Sebastes miniatus*)
	Blue rockfish (*Sebastes mystinus*)
	China rockfish (*Sebastes nebulosus*)
	Tiger rockfish (*Sebastes nigrocinctus*)
	Bocaccio (*Sebastes paucispinis*)
	Canary rockfish (*Sebastes pinniger*)
	Redstripe rockfish (*Sebastes proriger*)
	Yellowmouth rockfish (*Sebastes reedi*)
	Rosy rockfish (*Sebastes rosaceus*)
	Yelloweye rockfish (*Sebastes ruberrimus*)
	Stripetail rockfish (*Sebastes saxicola*)
	Pygmy rockfish (*Sebastes wilsoni*)
	Sharpchin rockfish (*Sebastes zacentrus*)
	Shortspine thornyhead (*Sebastolobus alascanus*)
	Longspine thornyhead (*Sebastolobus altivelis*)
Sablefishes and Skilfishes	Sablefish (*Anoplopoma fimbria*)
	Skilfish (*Erilepis zonifer*)
Greenlings and Lingcods	Kelp greenling (*Hexagrammos decagrammus*)
	Rock greenling (*Hexagrammos lagocephalus*)
	Whitespotted greenling (*Hexagrammos stelleri*)
	Lingcod (*Ophiodon elongates*)
	Painted greenling (*Oxylebius pictus*)
	Atka mackerel (*Pleurogrammus monopterygius*)
Combfishes	Longspine combfish (*Zaniolepis latipinnis*)
Sculpins	Coralline sculpin (*Artedius corallines*)
	Padded sculpin (*Artedius fenestralis*)
	Scalyhead sculpin (*Artedius harringtoni*)
	Smoothhead sculpin (*Artedius lateralis*)
	Puget Sound sculpin (*Artedius meanyi*)
	Bonehead sculpin (*Artedius notospilotus*)

Marine Fish Family	Marine Fish Species
	Rosylip sculpin (*Ascelichthys rhodorus*)
	Silverspotted sculpin (*Blepsias cirrhosis*)
	Roughback sculpin (*Chitonotus pugetensis*)
	Sharpnose sculpin (*Clinocottus acuticeps*)
	Calico sculpin (*Clinocottus embryum*)
	Mosshead sculpin (*Clinocottus globiceps*)
	Prickly sculpin (*Cottus asper*) - anadromous
	Coastrange sculpin (*Cottus aleuticus*) - anadromous
	Buffalo sculpin (*Enophrys bison*) - nearshore shelf demersal
	Red Irish lord (*Hemilepidotus hemilepidotus*)
	Brown Irish lord (*Hemilepidotus spinosus*)
	Northern sculpin (*Icelinus borealis*)
	Dusky sculpin (*Icelinus burchami*)
	Threadfin sculpin (*Icelinus filamentosus*)
	Fringed sculpin (*Icelinus fimbriatus*)
	Sculpin (*Icelinus oculatus*)
	Spotfin sculpin (*Icelinus tenuis*)
	Longfin sculpin (*Jordania zonope*)
	Pacific staghorn sculpin (*Leptocottus armatus*)
	Great sculpin (*Myoxocephalus polyacanthocephalus*)
	Sailfin sculpin (*Nautichthys oculofasciatus*)
	Nautichthys robustus (*Smallsail sculpin*)
	Tidepool sculpin (*Oligocottus maculosus*)
	Saddleback sculpin (*Oligocottus rimensis*)
	Fluffy sculpin (*Oligocottus snyderi*)
	Thornbacked sculpin (*Paricelinus hopliticus*)
	Slim sculpin (*Radulinus asprellus*)
	Darter sculpin (*Radulinus boleoides*)
	Spinynose sculpin (*Radulinus talyori*)
	Grunt sculpin (*Rhamphocottus richardsonii*)
	Cabezon (*Scorpaenichthys marmoratus*)
	Manacled sculpin (*Synchirus gilli*)
	Roughspine sculpin (*Triglops macellus*)
	Ribbed sculpin (*Triglops pingelii*)
	Flabby sculpin (*Zesticelus profundorum*)
Psychrolutids	Spinyhead sculpin (*Dasycottus setiger*)
	Blackfin sculpin (*Malacocottus kincaidi*)
	Darkfin sculpin (*Malacocottus zonurus*)
	Soft sculpin (*Gilbertidia sigalutes*)
	Tadpole sculpin (*Psychrolutes paradoxus*)
	Blob sculpin (*Psychrolutes phrictus*)
Poachers	Kelp poacher (*Agonomalus mozinoi*)

Marine Fish Family	Marine Fish Species
	Northern spearnose poacher (*Agonopsis vulsa*)
	Sturgeon poacher (*Agonus acipenserinus*)
	Smooth alligatorfish (*Anoplagonus inermis*)
	Gray starsnout poacher (*Bathyagonus alascanus*)
	Spinycheek starsnout poacher (*Bathyagonus infraspinatus*)
	Blackfin starsnout poacher (*Bathyagonus nigripinnis*)
	Bigeye starsnout poacher (*Bathyagonus pentacanthus*)
	Rockhead (*Bothragonus swanii*)
	Fourhorn poacher (*Hypsagonus quadricornis*)
	Warty poacher (*Occella verrucosa*)
	Pygmy poacher (*Odontopyxis trispinosa*)
	Tubenose poacher (*Pallasina barbata*)
	Pricklebreast poacher (*Stellerina xyosterna*)
	Blacktip poacher (*Xeneretmus latifrons*)
	Smootheye poacher (*Xeneretmus leiops*)
	Bluespotted poacher (*Xeneretmus triacanthus*)
Snailfishes	Snailfish (*Acantholiparis opercularis*)
	Snailfish (*Careproctus cypselurus*)
	Snailfish (*Careproctus gilberti*)
	Blacktail snailfish (*Careproctus melanurus*)
	Snailfish (*Careproctus ovigerum*)
	Snailfish (*Elassodiscus caudatus*)
	Pacific spiny lumpsucker (Eumicrotremus orbis)
	Spotted snailfish (Liparis callyodon)
	Ribbon snailfish (*Liparis cyclopus*)
	Marbled snailfish (*Liparis dennyi*)
	Tidepool snailfish (*Liparis florae*)
	Slipskin snailfish (*Liparis fucensis*)
	Slimy snailfish (*Liparis mucosus*)
	Showy snailfish (*Liparis pulchellus*)
	Ringtail snailfish (*Liparis rutteri*)
	Snailfish (*Lipariscus nanus*)
	Tadpole snailfish (*Nectoliparis pelagicus*)
	Snailfish (*Osteodiscus cascadiae*)
	Snailfish (*Paraliparis cephalus*)
	Snailfish (*Paraliparis dactylosus*)
	Prickly snailfish (*Paraliparis deani*)
	Snailfish (*Paraliparis mento*)
	Snailfish (*Paraliparis paucidens*)
	Snailfish (*Paraliparis pecoralis*)
	Snailfish (*Paraliparis rosaceus*)
	Snailfish (*Paraliparis ulochir*)

Marine Fish Family	Marine Fish Species
	Bering snailfish (*Polypera beringiana*)
	Lobefin snailfish (*Polypera greeni*)
	Snailfish (*Rhinoliparis attenuates*)
	Snailfish (*Rhinoliparis barbulifer*)
Temperate Basses	Striped bass (*Morone saxatilis*)
Sea Basses and Groupers	Kelp bass (*Paralabrax clathratus*)
Tilefishes	Ocean whitefish (*Caulolatilus princeps*)
Remoras	Whalesucker (*Remora australis*)
Jacks and Pompanos	Pilotfish (*Naucrates doctor*)
	Yellowtail (*Seriola lalandi*)
	Jack mackerel (*Trachurus symmetricus*)
Dolphinfishes	Dolphin (*Coryphaena hippurus*)
Pomfrets	Pacific pomfret (*Brama japonica*)
	Rough pomfret (*Taractes asper*)
Manefishes	Veilfin (*Caristius macropus*)
Croakers	White seabass (*Atractosion nobilis*)
	White croaker (*Genyonemus lineatus*)
Sea Chubs	Halfmoon (*Medialuna californiensis*)
Armorheads	Pelagic armorhead (*Pentaceros richardsoni*)
Surfperches	Calico surfperch (*Amphistichus koelzi*)
	Redtail surfperch (*Amphistichus rhodoterus*)
	Kelp surfperch (*Brachyistius frenatus*)
	Shiner surfperch (*Cymatogaster aggregate*)
	Pile surfperch (*Damalichthys vacca*)
	Striped surfperch (*Embiotoca lateralis*)
	Walleye surfperch (*Hyperprosopon argenteum*)
	Silver surfperch (*Hyperprosopon ellipticum*)
	White surfperch (*Phanerodon furcatum*)
Barracudas	California barracuda (*Sphyraena argentea*)
Ronquils	Stripefin ronquil (*Rathbunella hypoplecta*)
	Searcher (*Bathymaster signatus*)
	Northern ronquil (*Ronquilus jordani*)
Eelpouts	Twoline eelpout (*Bothrocara brunneum*)
	Eelpout (*Bothrocara molle*)
	Eelpout (*Bothrocara remigerum*)
	Cuskpout (*Derepodichthys alepidotus*)
	Snakehead eelpout (*Embryx crotalinus*)
	Eelpout (*Lycenchelys camchaticus*)
	Eelpout (*Lycenchelys jordani*)
	Eelpout (Lycodapus dermatinus)
	Eelpout (*Lycodapus endemoscotus*)
	Eelpout (*Lycodapus fierasfer*)

Marine Fish Family	Marine Fish Species
	Pallid eelpout (*Lycodapus mandibularis*)
	Eelpout (*Lycodapus pach*ysoma)
	Eelpout (*Lycodapus parviceps*)
	Shortfin eelpout (*Lycodes brevipes*)
	Bigfin eelpout (*Lycodes cortezianus*)
	Black eelpout (*Lycodes diapterus*)
	Blackbelly eelpout (*Lycodes pacifica*)
	Wattled eelpout (*Lycodes palearis*)
	Eelpout (*Lycodes sp*.)
	Eelpout (*Lyconema barbatum*)
	Midwater eelpout (*Melanostigma pammelas*)
	Eelpout (*Pachycara bulbiceps*)
	Eelpout (*Taranetzella lycoderma*)
Pricklebacks	Y-prickleback (*Allolumpenus hypochromus*)
	Slender cockscomb (*Anoplarchus insignis*)
	High cockscomb (*Anoplarchus purpurescens*)
	Decorated warbonnet (*Chirolophis decorates*)
	Mosshead warbonnet (*Chirolophis nugatory*)
	Daubed shanny (*Lumpenus maculatus*)
	Snake prickleback (*Lumpenus sagitta*)
	Ribbon prickleback (*Phytichthys chirus*)
	Bluebarred prickleback (*Plectobranchus evides*)
	Whitebarred prickleback (*Poroclinus rothrocki*)
	Black prickleback (*Xiphister atropurpureus*)
	Rock prickleback (*Xiphister mucosus*)
Wrymouths	Giant wrymouth (*Delolepis gigantean*)
	Dwarf wrymouth (*Lyconectes aleutensis*)
Gunnels	Penpoint gunnel (*Apodichthys flavidus*)
	Longfin gunnel (*Pholis clemensi*)
	Crescent gunnel (*Pholis laeta*)
	Saddleback gunnel (*Pholis ornate*)
	Red gunnel (*Pholis schultzi*)
	Rockweed gunnel (*Xererpes fucorum*)
Wolffishes	Wolf-eel (*Anarrhichthys ocellatus*)
Quillfish	Quillfish (*Ptilichthys goodie*)
Prowfishes	Prowfish (*Zaprora Silenus*)
Graveldiggers	Graveldigger (*Scytalina cerdale*)
Sandfishes	Pacific sandfish (*Trichodon trichodon*)
Kelpfishes	Striped kelpfish (*Gibbonsia metzi*)
	Crevice kelpfish (*Gibbonsia montereyensis*)
	Giant kelpfish (*Heterostichus rostratus*)
Ragfishes	Ragfish (*Icosteus aenigmaticus*)

Marine Fish Family	**Marine Fish Species**
Sand Lances	Pacific sand lance (*Ammodytes hexapterus*)
Gobies	Arrow goby (*Clevelandia ios*)
	Blackeye goby (*Coryphopterus nicholsii*)
	Bay goby (*Lepidogobius Lepidus*)
Cutlassfishes	Black scabbardfish (*Aphanopus carbo*)
	Frostfish (*Benthodesmus elongates*)
Mackerels and Tunas	Skipjack tuna (*Euthynnus pelamis*)
	Pacific bonito (*Sarda chiliensis*)
	Pacific (chub) mackerel (*Scomber japonicas*)
	Albacore (*Thunnus alalunga*)
	Yellowfin tuna (*Thunnus albacares*)
	Bigeye tuna (*Thunnus obesus*)
	Bluefin tuna (*Thunnus thynnus*)
Swordfishes	Swordfish (*Xiphias gladius*)
Louvar	Louvar (*Luvarus imperialis*)
Medusafishes	Medusafish (*Icichthys lockingtoni*)
Squaretails	Smalleye sqaretail (*Tetragonurus cuvieri*)
Butterfishes	Pacific butterfish (*Peprilus simillimus*)
Lefteye Flounders	Pacific sanddab (*Citharichthys sordidus*)
	Speckled sanddab (*Citharichthys stigmaeus*)
	California halibut (*Paralichthys californicus*)
Righteye Flounders	Arrowtooth flounder (*Atheresthes stomias*)
	Roughscale sole (*Clidoderma asperrimum*)
	Deepsea sole (*Embassichthys bathybius*)
	Petrale sole (*Eopsetta jordani*)
	Rex sole (*Glyptocephalus zachirus*)
	Flathead sole (*Hippoglossoides elassodon*)
	Pacific halibut (*Hippoglossus stenolepis*)
	Hybrid sole (*Inopsetta ischyra*)
	Butter sole (*Isopsetta isolepis*)
	Rock sole (*Lepidopsetta bilineata*)
	Slender sole (*Lyopsetta exilis*)
	Dover sole (*Microstomus pacificus*)
	English sole (*Parophrys vetulus*)
	Starry flounder (*Platichthys stellatus*)
	C-O turbot (sole) (*Pleuronichthys coenosus*)
	Curlfin turbot (sole) (*Pleuronichthys decurrens*)
	Sand sole (*Psettichthys melanostictus*)
	Greenland halibut (*Reinhardtius hippoglossoides*)
Tonguefishes	California tonguefish (*Symphurus atricauda*)
Triggerfishes and Filefishes	Finescale triggerfish (*Balistes polylepis*)
Molas	Ocean sunfish (*Mola mola*)

Source: (University of Puget Sound, 2016)

Sportfishing is popular in both marine and freshwater systems in Washington. Table 8.1.6-5 presents a list of popular saltwater sportfish in Washington.

Table 8.1.6-5: Popular Saltwater Sportfish Species in Washington

Common Name	General Habitat
Tuna (albacore, mackerel, yellowfin, skip jack, and northern Bluefin)	Open seas and clear water, seldom close to shore
Herring, Anchovy, Sandlance, Smelt, and Sardine	Found in bays
Salmon (Chum, Coho, pink, sockeye, chinook, steelhead, cutthroat)	Found in booth deep and upper waters in bays and estuaries
Dogfish shark	Deep waters
Sturgeon (white)	Dwell on the bottom of deep holes in upper bays
Halibut	Found on or near the bottom of deep waters, nearshore and beyond the continental shelf
Rockfish	Prefers rocks and jetties and does not venture far from cover
Bass (largemouth, smallmouth, rock, stripped)	Lowland lakes and ponds
Tiger muskie	Shallow weedy bays; prefer to hide near or under hard structures (e.g. docks)
Walleye	Found in inland lakes and large rivers; prefer rocky bottoms.
Whitefish	Lakes and large streams
Burbot	Deep lakes
Catfish	Found in large river systems and the lower reaches of their tributaries as well as lowland lakes.
Trout (brown, rainbow, golden, tiger, cutthroat, lake kokanne, and grayling)	Inhabit cold clear rivers, streams, lakes and can be anadromous.
Crappie	Inland lakes
Northern pikeminnow	Lakes and streams
Peamouth chub	Lakes and streams
Perch	Shoreline areas in lakes and reservoirs, brackish water at river mouths
Suckers	Lakes ponds, creeks, and tributary streams
Sunfish	Clear lakes with abundant vegetation but can be found in turbid waters with little vegetation

Source: (University of Puget Sound, 2015b) (University of Puget Sound, 2016) (WDFW, 2015c).

There are 18 marine fish species or species units (e.g., ESUs or DPSs) listed as SGCN in Washington, including: Bluntnose Sixgill Shark (*Hexanchus griseus*), Broadnose Sevengill Shark (*Notorynchus cepedianus*), Bocaccio – Puget Sound/Georgia Basin DPS (*Sebastes paucispinis*), Brown Rockfish (*Sebastes auriculatus*), Canary Rockfish (*Sebastes pinniger*) – Puget Sound /Georgia Basin DPS, China Rockfish (*Sebastes pinniger*), Copper Rockfish (*Sebastes caurinus*), Greenstriped Rockfish (*Sebastes elongatus*), Quillback Rockfish (*Sebastes maliger*), Redstripe Rockfish (*Sebastes proriger*), Tiger Rockfish (*Sebastes nigrocinctus*), Yelloweye Rockfish (*Sebastes ruberrimus*) – Puget Sound/Georgia Basin DPS, Pacific Cod (*Gadus macrocephalus*) – Salish Sea Population, Pacific Hake (*Merluccius productus*) – Georgia Basin DPS, Pacific Herring (*Clupea pallasii*) – Georgia Basin DPS, Pacific Sand Lance

(*Ammodytes hexapterus*), Surf Smelt (*Hypomesus pretiosus*), Walleye Pollock (*Gadus chalcogrammus*) **–** South Puget Sound (WDFW, 2015b).

Shellfish and Other Invertebrates

Washington has an important shell-fishing industry that brings in $270 million annually to the region's economy (NOAA, 2012a). The Washington shellfish initiative began in 2007 with a goal to protect and enhance shellfish resources in Washington. The following species can be found in offshore waters of Washington: abalone (*Haliotis kamtschatkana*), manila clams (*Venerupis philippinarum*), native littlenecks (*Leukoma staminea*), butter clams (*Saxidomus gigantea*), varnish clams (*Nuttallia obscurata*), cockles (*Clinocardium nuttallii*), macoma clams (*Macoma nasuta, M. brota*), horse clams (*Tresus nuttallii*, *T. capax*), eastern softshell clams (*Mya arenaria*), geoduck (*Panopea generosa*), razor clams (*Siliqua patula*), mussels (*Mytilus trossulus, M. californianus*), oysters (*Crassostrea gigas, Ostrea conchaphila*), Dungeness crab (*Cancer magister*), red rock crab (*Cancer productus*), box crab (*Lopholithodes foraminatus*), king crab (*Lopholithodes mandtii*), shore crab (*Hemigrapsus* spp.), crayfish (*Pacifastacus leniusculus*), shrimp (*Pandalus spp., Pandalopsis dispar*), and squid (*Loligo opalescens*) (WDFW, 2015c).

Eugene Kozloffed documented over 3,000 marine invertebrates in the Puget Sound region in 1974 (Kozloff, 1974). In addition, the Washington DOE initiated a Marine Sediment Monitoring Program in 1989 and has collected over 1800 taxa of benthic infaunal invertebrates such as worms (*Abarenicola* spp., *Alitta succinea, Austrobilharzia variglandis, Clymenella torquata, Driloleirus americanus, Heteromastus filiformis, Homadaula anisocentra, Limnodriloides monothecus, Lyrodus takanoshimensis, Sabellid* spp., *Tubificoides* spp.) and snails (*Algamorda newcombiana, Allogona* spp., *Amnicola* spp., *Candidula intersecta, Catinella* spp., *Cepaea nemoralis, Cernuella virgate, Cipangopaludina chinensis, Crepidula* spp., *Cryptomastix populi, Fluminicola* spp., *Fossaria* spp., *Haminoea japonica, Helix aspersa, Ilyanassa obsoleta, Liparis* spp., *Lipariscus nanus, Lyogyrus sp., Microphysula* spp., *Monadenia fidelis minor, Myosotella myosotis, Nassarius* spp., *Nectoliparis pelagicus, Olivella biplicata, Oreohelix* spp., *Oxychilus* spp., *Oxyloma* spp., *Polinices lewisii, Potamopyrgus antipodarum, Pyrgulopsis robusta, Stagnicola* spp., *Succinea* spp., *Vitrea contracta, Vitrina pellucida*). A full list of benthic species collected by Washington DOE can be found on the Encyclopedia of Puget Sound's website, published by the University of Washington (Encyclopedia of Puget Sound, 2015).

There are 95 invertebrates species or species units (e.g., ESUs or DPSs) listed as SGCN in Washington, including: Caddisflies (*Trichoptera*) (six taxa included), Mayflies (*Ephemeroptera*) (four taxa included), Noctuid Moths (*Noctuidae*) (three taxa included), Ashy Pebblesnail (*Fluminicola columbiana*), Barren Juga (*Juga hemphilli hemphilli*), Beller's Ground Beetle (*Agonum belleri*), Bluegray Taildropper (*Prophysaon coeruleum*), Brown Juga (*Juga sp. 3*), California Floater (*Anodonta californiensis*), Cascades Needlefly (*Megaleuctra kincaidi*), Chelan Mountainsnail (*Oreohelix sp. 1*), Chinquapin Hairstreak (*Habrodais grunus herri*), Columbia Clubtail (*Gomphurus lynnae*), Columbia Oregonian (*Cryptomastix hendersoni*), Columbia River Tiger Beetle (*Cicindela columbica*), Crowned Tightcoil (*Pristiloma Pilsbryi*), Dalles Hesperian (*Vespericola depressa*), Dalles Juga (*Juga hemphilli dallesensis*), Dalles Sideband (*Monadenia* *fidelis minor*), Dry Land Forestsnail (*Allogona ptychophora solida*), Giant Palouse Earthworm (*Driloleirus americanus*), Great Arctic (*Oeneis nevadensis gigas*), Hatch's Click Beetle (*Eanus hatchi*), Hoary Elfin (*Callophrys polios*), Hoder's Mountainsnail (*Oreohelix n. sp.*), Hoko Vertigo (*Vertigo sp. 1*), Idaho Vertigo (*Vertigo idahoensis*), Island Marble (*Euchloe ausonides insulana*), Johnson's Hairstreak (*Callophrys johnsoni*), Juniper Hairstreak (*Callophrys gryneus*), Leschi's Millipede (*Leschius mcallisteri*), Limestone Point Mountainsnail (*Oreohelix sp. 18*), Mad River Mountainsnail (*Oreohelix n. sp*), Makah Copper (*Lycaena mariposa charlottensis*), Mann's Nollusk-eating Ground Beetle (*Scaphinotus mannii*), Mardon Skipper (*Polites mardon*), Masked Duskysnail (*Lyogyrus n. sp. 2*), Meadow Fritillary (*Boloria bellona*), Mission Creek Oregonian (*Cryptomastix magnidentata*), Monarch (*Danaus plexippus plexippus*), Morrison's Bumblebee (*Bombus morrisoni*), Nimapuna tigersnail (*Anguispira nimapuna*)**,** Northern (pinto) abalone (*Haliotis kamtschatkana*), Northern Forestfly (*Lednia borealis*), Olympia oyster (*Ostrea lurida*), Olympia Pebblesnail (*Fluminicola virens*), One-band Juga (*Juga sp. 8*), Oregon Branded Skipper (*Hesperia Colorado oregonia*), Oregon Megomphid (*Megomphix hemphilli*), Oregon Silverspot (*Speyeria zerene hippolyta*), Pacific Clubtail (*Gomphus kurilis*)**,** Pacific Needlefly (*Megaleuctra complicata*), Pacific Vertigo (*Vertigo andrusiana*), Poplar Oregonian (*Cryptomastix (Bupiogona) populi*), Propertius' Duskywing (*Erynnis propertius*), Puget Blue (*Plebejus icarioides blackmorei*), Puget Oegonian (*Cryptomastix devia*), Puget Sound Fritillary (*Speyeria cybele pugetensis*), Rainier Roachfly (*Soliperla fenderi*), Ranne's Mountainsnail (*Oreohelix n. sp*.), Salmon River Pebblesnail (*Fluminicola gustafsoni),* Sand-verbena Moth (*Copablepharon fuscum*), Sasquatch Snowfly (*Bolshecapnia sasquatchi),* Shortface Lanx (*Fisherola nuttalli)*, Silver-bordered Fritillary (*Boloria selene atrocostalis),* Siuslaw Sand Tiger Beetle (*Cicindela hirticollis siuslawensis),* Sonora Skipper (*Polites sonora siris),* Spotted Taildropper (*Prophysaon vanattae pardalis),* Straits Acmon Blue (*Icaricia acmon ssp.),* Subarctic Bluet (*Coenagrion interrogatum),* Suckley Cuckoo Bumblebee (*Bombus suckleyi),* Talol Springfly (*Pictetiella lechleitneri),* Taylor's Checkerspot (*Euphydryas editha taylori),* Three-band Juga (*Juga sp. 7),* Valley Silverspot (*Speyeria zerene bremnerii),* Washington Duskysnail (*Amnicola sp. 2),* Wenatchee Forestfly (*Malenka Wenatchee),* Western Bumblebee (*Bombus occidentalis),* Western Pearlshell (*Margaritifera falcate),* Western Ridged Mussel (*Gonidea angulate),* White-belted Ringtail (*Erpetogomphus compositus),* Winged Floater (*Anodonta nuttaliana),* Yosemite Springfly (*Megarcys Yosemite),* Yuma Skipper (*Ochlodes Yuma)* (WDFW, 2015b).

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act identifies and protects those fish habitats that are necessary for spawning, breeding, feeding, or growth to maturity. These habitats are termed "Essential Fish Habitat" or EFH. NOAA provides an online mapping application and website to provide the public a means to obtain illustrative representations of EFH. This tool is used to identify the existing conditions for a project location to identify sensitive resources. Washington Appendix B, Table B-2 summarizes of EFH offshore of Washington.

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

In addition, three federal fishery management plans and their associated EFH are applicable to projects within Washington: the Pacific coast groundfish fishery, the coastal pelagic species fishery, and the Pacific Coast salmon fishery. The Pacific groundfish fishery includes approximately 55 species in Washington, the coastal pelagic fishery includes pacific sardine (*Sardinops sagax caerulea*), pacific mackerel (*Scomber japonicus*), northern anchovy (*Engraulis mordax*), jack mackerel (*Trachurus symmetricus*), and the market squid (*Doryteuthis opalescens*), and the Pacific salmon fishery includes Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), and Puget Sound pink salmon (*O. gorbuscha*) (WSDOT, 2015b).

Marine Mammals

An estimated 27 different species of marine mammals occur in Pacific coastal waters, including whales, dolphins, porpoises, and pinnipeds. Pinnipeds found in Washington may occur in oceans, estuaries, and coastal rivers, porpoises prefer near shore, estuaries, and bays, while whales and dolphins occur primarily in offshore coastal waters. Common species observed in Washington waters include harbor seals (*Phoca vitulina*), Northern fur seal (*Callorhinus ursinus*), Northern elephant seals (*Mirounga angustirostris*), the California sea lion (*Zalophus californianus*), the Northern sea lion (*Eumetopias jubatus*), and the grey whale (*Eschrichtius robustus*).

Less common species include: the Sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), striped dolphin (*Stenella coeruleoalba*), common dolphin (*Delphinus delphis*), grampus (*Grampus griseus*), short-finned pilot whale (*Globicephala macrorhynchus*), northern right-whale dolphin (*Lissodelphis borealis*), killer whale (*Orcinus orca*), false killer whale (*Pseudorca crassidens*), Goose-beaked whale (*Ziphius cavirostris*), Bearing sea beaked whale (*Mesoplodon stejnegeri*), arch-beaked whale (*Mesoplodon carlhubbsi*), Baird’s beaked whale (*Berardius bairdii*), the Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), harbor porpoise (*Phocoena phocoena*), Dall’s porpoise (*Phocoenoides dalli*), North Pacific right whale (*Eubalaena japonica*), humpback whale (*Megaptera novaeangliae*), Minke whale (*Balaenoptera acutorostrata*), and blue whale (*Balaenoptera musculus*) (University of Puget Sound, 2015a).

The Marine Mammal Protection Act (MMPA) (16 U.S.C. § 1361 *et seq.*) prohibits takes of all marine mammals in the U.S. (including territorial seas) with few exceptions. Permits for scientific research on marine mammals and permits to enhance the survival or recovery of a species, issued under Section 104 of the MMPA, are tw such exceptions. For threatened and endangered marine mamamls, any activities that may affect ESA-listed species must be consistent with the ESA as well.

Sea Turtles

Four species of sea turtles occur in Washington. These include the green sea turtle (*Chelonia mydas*), the leatherback sea turtle (*Dermochelys coriacea*), the loggerhead sea turtle (*Caretta caretta*), and olive ridley sea turtle (*Lepidochelys olivacea*). Three of these four species are listed as threatened or endangered by the USFWS and are discussed in more detail in section 8.1.6.6 Threatened and Endangered Species and Species of Concern.

Invasive Aquatic Species

The Washington Invasive Species Council (Council) evaluates over 700 invasive plant, aquatic, and wildlife species in and in close proximity to Washington. Of the 700 species evaluated, the Council has selected 50 priority species that pose the greatest threat to the state's environment, economy, and human health. Terrestrial and aquatic plant species are in Table 8.1.6-3. Other terrestrial invasive species are discussed in section 8.1.6.4. The invasive aquatic species identified by the Council include the following (Invasive Species Council, 2015):

- Asian carp (Mylopharyngodon piceus, Hypophthalmichthys nobilis, Hypophthalmichthys molitrix, Ctenopharyngodon idella),
- Atlantic salmon (*Salmo salar*),
- Bullfrog (Rana catesbeiana),
- European green crab (*Carcinus maenas*),
- Invasive crayfish (Procambarus clarkii, Orconectes rusticus),
- Marine clam (Corbula amurensis),
- Mitten crab (Eriocheir sinensis),
- New Zealand mud snail (*Potamopyrgus antipodarum*),
- Northern snakehead (*Channa argus*),
- Viral hemorrhagic septicemia virus (*Novirhabdovirus sp.*),
- Zebra mussels (*Dreissena polymorpha*) and
- Quagga mussels (*Dreissena bugensis*).

8.1.6.6. 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 the state of Washington. The USFWS has identified 16 federally endangered and 34 federally threatened species known to occur in Washington[94], with one species listed as both endangered and

[94] The USFWS ECOS list identifies species with distinct population segments or geographically isolated populations as individual species in the total species count. This PEIS describes the ESA-listed species with descriptions for the geographic distinctions and does not count them as different types of list species unless distinct populations are listed as threatened and

threatened depending on the population (USFWS, 2015c). Further, the USFWS identifies four fish species that are listed multiple times for populations that occur in different geographic locations in the state[95] (USFWS, 2015c). Hence the number of distinct federally listed species in Washington is 40. Critical habitat[96] has been designated for 21 species (USFWS, 2015c). Five candidate species[97] are identified by USFWS as occurring within the state (USFWS, 2015e). Candidate species are not afforded statutory protection under the ESA. However, the USFWS recommends taking these species into consideration during environmental planning because they could be listed in the future (USFWS, 2014b). Listed species in Washington include 12 mammals, 3 reptiles, 6 birds, 5 fish, 1 amphibian, 2 invertebrates, and 11 plants, and are discussed in detail under the following sections. Figure 8.1.6-3 shows critical habitat in Washington.

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

endangered. Therefore, this PEIS has ESA listed species totals that differ slightly than the reported ECOS total but covers the same species.

[95] The following species have multiple occurrences on the USFWS ECOS list for different geographic locations within the state: Chinook salmon (*Oncorhynchus tshawytscha*), Chum salmon (*Oncorhynchus keta*), Sockeye salmon (*Oncorhynchus nerka*), and Steelhead (*Oncorhynchus mykiss*).

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

[97] 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, 2014b).

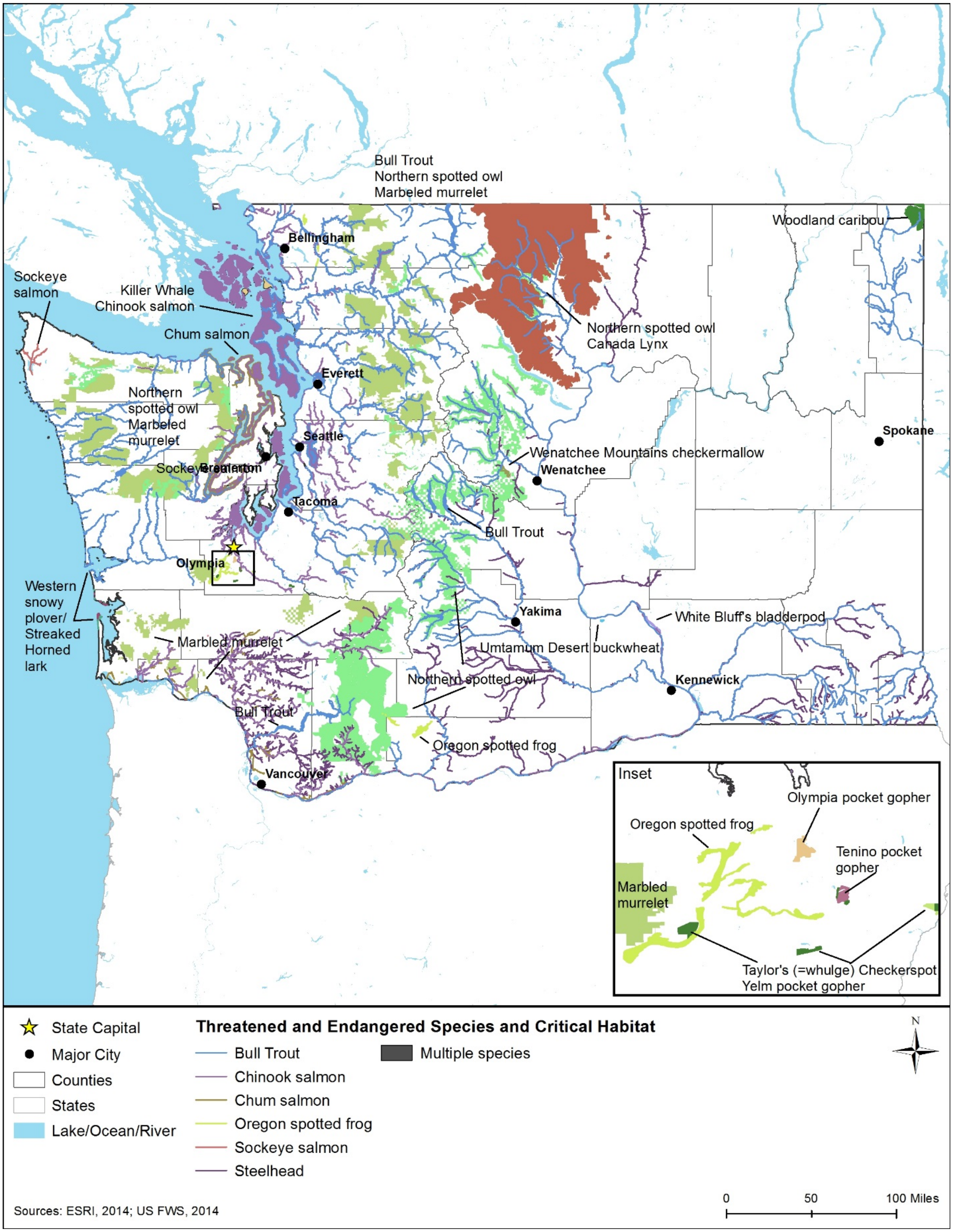


Figure 8.1.6-3: ESA Designated Critical Habitat for the State of Washington

Mammals

Six endangered and six threatened mammal species are federally listed for Washington as summarized in Table 8.1.6-6. The Gray Wolf (*Canis lupus*) occurs in mountainous forested areas of western Washington. The Olympia pocket gopher (*Thomomys mazama pugetensis*), Roy Prairie pocket gopher (*Thomomys mazama glacialis*), Tenino Pocket Gopher (*Thomomys mazama tumuli*), and the Yelm pocket gopher (*Thomomys mazama yelmensis*) occur in the prairie lands of western Washington. The Columbian white-tailed deer (*Odocoileus virginianus leucurus*) occurs along the Columbia River in southwestern Washington. The grizzly bear (*Ursus arctos horribilis*) and the Pygmy Columbia basin rabbit (*Brachylagus idahoensis*) occur in central Washington. The Canada lynx (*Lynx canadensis*) occurs in boreal forests in central, north, and northwestern Washington. The Woodland caribou (*Rangifer tarandus caribou*) occur in the southern Selkirk Mountains in the northeastern portion of the state. The humpback whale (*Megaptera novaeangliae*) occurs off the coast of Washington. The killer whale (*Orcinus orca*) occurs off the coast of Washington and within Puget Sound (USFWS, 2015c). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Washington is provided below.

Table 8.1.6-6: Federally Listed Mammal Species of Washington

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Washington	Habitat Description
Canada Lynx	*Lynx canadensis*	T	Yes; along the Central-North Region of Washington	Boreal forests inhabited by spruce and fir in central, north, and northwestern Washington.
Columbia Basin Pygmy Rabbit	*Brachylagus idahoensis*	E	No	Sagebrush in Benton, Douglas, and Grant Counties, central Washington.
Columbian White-tailed Deer	*Odocoileus virginianus leucurus*	E	No	Densely forested riparian regions to oak-savannah habitats in southwest Washington.
Gray Wolf	*Canis lupus*	E	No	Mountainous forested lands in 30 counties in central and eastern Washington.
Grizzly Bear	*Ursus arctos horribilis*	T	No	Alpine forests to mixed shrub fields to grasslands throughout central Washington.
Olympia Pocket Gopher	*Thomomys mazama pugetensis*	T	Yes; the area around the Olympia Airport south of the cities of Olympia and Tumwater, Washington.	Prairie lands in Thurston County, western Washington.
Roy Prairie Pocket Gopher	*Thomomys mazama glacialis*	T	No	Prairie lands in Pierce County, western Washington.
Tenino Pocket Gopher	*Thomomys mazama tumuli*	T	Yes; Rock Prairie in Thurston County, Washington.	Prairie lands in Thurston County, western Washington.
Woodland Caribou	*Rangifer tarandus caribou*	E	Yes; Pend Oreille county	Southern Selkirk Mountains

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Washington	Habitat Description
Yelm Pocket Gopher	*Thomomys mazama yelmensis*	T	Yes; Tenalquot Prairie and Rock Prairie in Thurston County, Washington.	Prairie lands in Thurston County, western Washington.
Humpback Whale	*Megaptera novaeangliae*	E	No	Open Ocean off the coast of Washington.
Killer Whale	*Orcinus orca*	E	Yes; three distinctive areas in Puget Sound, Washington.	Open Ocean off the coast of Washington and within Puget Sound.

Source: (USFWS, 2015c)

[a] E = Endangered, T = Threatened

Canada Lynx. The Canada lynx is an average-sized cat (ranging from 30 to 35 inches long and 14 to 31 pounds) with “large, well-furred paws, long, black ear tufts, and a short, black-tipped tail” that separates it from a bobcat (USFWS, 2013b). This cat inhabits boreal forests dominated by spruce and fir, and is skilled at hunting in deep snow. Their primary prey is the snowshoe hare *(Lepus americanus)* and as a result the abundance and survival of the Canada lynx is directly related to the density and health of regional snowshoe hare populations. The species was federally listed as endangered in 2000 (65 FR 16053 16086, January 24, 2000). Only a few places in the lower 48 states regularly support the Canada lynx populations. In Washington, it can be found in eight counties in the northern, northwestern, and central parts of the state (USFWS, 2015f).

The Canada lynx was listed in 2000 primarily concerning habitat destruction, the need for more regulatory control, and consistent guidance for forest management activities. Given the lynx travels back and forth between the U.S. and Canada, contiguous habitat is important for this species. In addition, snowshoe hare habitat is also important because of the direct link between snowshoe hare abundance and lynx abundance and survival. In 2006, a region along the Central-North Region of Washington was designated as Canada Lynx critical habitat (71 FR 66008 66061, November 9, 2006). While incidental take of lynx from hunting or trapping is possible, available data does not show this to be a substantial threat (USFWS, 2005) (USFWS, 2013b).

Columbia Basin Pygmy Rabbit. The Columbian Basin pygmy rabbit is the smallest rabbit in North America, measuring only 11 inches (WDFW, 2013). It is slate in color and has a buff colored tail. The species was federally listed as endangered in 2003 (68 FR 10388 10409, March 5, 2003). It can only be found in the central part of Washington in three counties, Benton, Douglas, and Grant (USFWS, 2015g).

The pygmy Columbia basin rabbit digs its own burrow. It generally lives in areas of dense sagebrush and feeds off the sagebrush throughout the year. Threats to this species include habitat loss and fragmentation primarily from agricultural development. (WDFW, 2013)

Columbian White-tailed Deer. The Columbian white-tailed deer is red-brown in color in the summer and gray in the winter, and has white rings around the eyes and behind the nose (USFWS, 2015h). It has a longer tail than the similar mule and black-tail deer. Their tails have brown coloring on the dorsal (upper) surface, and adult male white-tail deer have distinguished antlers “with prongs arising from a single main beam.” The Columbian white-tailed deer was federally listed as endangered in 1967 (32 FR 4001, March 11, 1967). Regionally, this species is found along the Columbia River in Oregon and Washington. In Washington, it can be found along the Columbia River in Clark, Cowlitz, and Wahkiakum Counties, in the southwest part of the state (USFWS, 2015am).

It inhabits the bottomlands and prairie woodlands of river basins. The Columbian White-tailed deer are considered browsers which graze and forage along the densely forested riversides and grasslands along the Columbia River. The main threat to the Columbian white-tailed deer is habitat loss, fragmentation, and modification, although these have become less of a threat. (USFWS, 2015h)

Gray Wolf. The gray wolf ranges in color to black, white, or gray. Adults weigh between 70 to 110 pounds. Gray wolves are a highly social species and live in packs. Wolves hunt with their pack and feed primarily on deer, elk, and moose (USFWS, 2015i). Gray wolves were federally listed as endangered in 1978 (43 FR 9607 9615, March 9, 1978). The endangered population of this species is found in California, Michigan, Oregon, Washington, and Wisconsin. In Washington, it can be found in 30 counties in the central and eastern parts of the state (USFWS, 2015j).

Suitable habitat includes mountainous, forested habitat. Wolves are considered "habitat generalists" and therefore can inhabit a wide range of habitats. Primary threats to this species include conflicts with humans such as unregulated hunting. This has resulted in gray wolves becoming eradicated form most of its range within the continental United States. (USFWS, 2015i)

Grizzly Bear. The grizzly's fur ranges in color from light brown to nearly black. A male grizzly bear "stands at approximately 7 feet tall and weighs from 300 to 600 pounds (and occasionally more than 800 pounds)," while females weigh between 200 to 400 pounds (USFWS, 2007a). Grizzly bears were federally listed as threatened in 1975 (40 FR 31734 31736, July 25, 1975). This species is found throughout central Washington in the following counties: Benton, Chelan, Douglas, Ferry, Grant, King, Kittitas, Klickitat, Okanogan, Pend Oreille, Skagit, Snohomish, Stevens, Whatcom, and Yamika (USFWS, 2015k).

Grizzly Bear Photo credit: USFWS

Suitable habitat ranges from alpine forests to mixed shrub fields to grasslands. Grizzlies tend to be at lower elevations in the spring and higher elevations during hibernation. Hibernation usually begins in October or November and lasts until March, sometimes extending to May (USFWS, 2007a). The primary threats to this species include conflicts with humans, such as livestock depredation or unregulated hunting, and habitat loss or fragmentation[98] from various types of development ranging from new roads, logging, energy and mineral exploration, and recreation (Servheen, 1993) (USFWS, 2007a).

Olympia Pocket Gopher. The Olympia pocket gopher is a burrowing animal with brown or yellowish brown fur. It has large clawed front hands, short strong legs and small ears and eyes (USFWS, 2015l). The Olympia pocket gopher was federally listed as threatened in 2014 (79 FR 19759 19796, April 9, 2014). Critical habitat was designated in 2014 (79 FR 19711 19757, April 9, 2014) and consists of the area around the Olympia Airport south of the cities of Olympia and Tumwater (USFWS, 2014c). The gopher can only be found in Thurston County, western Washington (USFWS, 2015l).

The pocket gopher spends most of its time living in its burrow, therefore its habitat is dependent on soil conditions. They prefer deep, light-textured, well drained soils. They eat a wide variety of plant material including roots and fleshy plant parts. Concerns for this species include habitat loss and degradation from urban development and fire suppression (WDFW, 2012a).

Roy Prairie Pocket Gopher. The Roy prairie pocket gopher is a burrowing animal with brown or yellowish brown fur. It has large clawed front hands, short strong legs and small ears and eyes (USFWS, 2015m). The Roy prairie pocket gopher was federally listed as threatened in 2014 (79 FR 19759 19796, April 9, 2014). No critical habitat was designated for the Roy prairie pocket gopher. The gopher is only found in Pierce County, western Washington (USFWS, 2015m).

The pocket gopher spends most of its time living in its burrow, therefore their habitat is dependent on soil conditions. They prefer deep, light-textured, well drained soils. They eat a wide variety of plant material including roots and fleshy plant parts. Concerns for this species include habitat loss and degradation from urban development and fire suppression (WDFW, 2012a).

Tenino Pocket Gopher. The Tenino pocket gopher is a burrowing animal with brown or yellowish brown fur. It has large clawed front hands, short strong legs and small ears and eyes (USFWS, 2015n). The Tenino pocket gopher was federally listed as threatened in 2014 (79 FR 19759 19796, April 9, 2014). Critical habitat was designated in 2014 (79 FR 19711 19757, April 9, 2014) and includes the Rock Prairie in Thurston County (USFWS, 2014c). The gopher is only found in Thurston County, western Washington (USFWS, 2015n).

The pocket gopher spends most of its time living in its burrow, therefore its habitat is dependent on soil conditions. They prefer deep, light-textured, well drained soils. They eat a wide variety of plant material including roots and fleshy plant parts. Concerns for this species include habitat loss and degradation from urban development and fire suppression (WDFW, 2012a).

Woodland Caribou. According to USFWS, "[Woodland] Caribou have large, concave hoofs that spread widely to support the animal in snow and soft tundra. The feet also function as paddles when caribou swim. Caribou are the only member of the deer family (Cervidae) in which both [genders] grow antlers. Antlers of adult bulls are large and massive; those of adult

[98] 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, 2016a).

cows are much shorter and are usually more slender and irregular. In late fall, caribou are clove-brown with a white neck, rump, and feet and often have a white flank stripe. The hair of newborn calves is generally reddish-brown. Newborn calves weigh an average of 13 pounds (6 kg) and grow very quickly. They may double their weight in 10-15 days. Weights of adult bulls average 350-400 pounds (159-182 kg)." (USFWS, 2015at)

Yelm Pocket Gopher. The Yelm pocket gopher is a burrowing animal with brown or yellowish brown fur. It has large clawed front hands, short strong legs and small ears and eyes (USFWS, 2015o). The Tenino pocket gopher was federally listed as threatened in 2014 (79 FR 19759 19796, April 9, 2014). Critical habitat was designated in 2014 (79 FR 19711 19757, April 9, 2014) and includes the Tenalquot Prairie and Rock Prairie in Thurston County (USFWS, 2014c). The gopher is only found in Thurston County, western Washington (USFWS, 2015o).

The pocket gopher spends most of its time living in its burrow, therefore its habitat is dependent on soil conditions. They prefer deep, light-textured, well drained soils. They eat a wide variety of plant material including roots and fleshy plant parts. Concerns for this species include habitat loss and degradation from urban development and fire suppression. (WDFW, 2012a)

Marine Mammals

Humpback Whale. The humpback whale reaches 30 to 60 feet in length and is distinguished from other whales by its robust, thick, and chunky body shape and very long (up to 15 feet) white flippers (NOAA, 2015c). The humpback whale was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.) (USFWS, 2015p). Humpback whales are found in all of the world's oceans. In the North Pacific, humpback whales migrate seasonally from northern feeding areas in the summer to southern feeding habitats in the winter. Breeding areas are more geographically separated than the feeding area and the whales rarely move between the designed breeding regions. The California/Oregon/Washington stock of humpback whales spend their winters in coastal Central America and Mexico and migrate to areas ranging from the coast of California up to southern British Columbia in the summer and fall (NOAA, 2015d). Humpback whales are known to feed in waters off Washington's coast and most occur from July through September (NOAA, 2015d) (WDFW, 2012b) .

Current threats to this species include entanglement in fishing gear, vessel strikes, harassment from whale watching, habitat degradation, and utilization from commercial, recreational, scientific, or educational purposes (USFWS, 2015p).

Killer Whale. The killer whale is a marine mammal with a characteristically marked black back and white chest and side and white mark around the eye. Males can be up to 31 feet long and weigh over 6 tons. Females are smaller, typically 28 feet long and weighing about 5 tons (USFWS, 2015q). Their size makes them the fastest marine mammals. The southern resident killer whale was federally listed as endangered in 2005 (70 FR 69903 69912 November 18, 2005). There are three forms of killer whales: residents, transients, and offshores. Resident killer whales in the U.S. waters can be found from Alaska to California. Critical habitat was designated in 2006 with approximately 2,560 square miles of marine habitat. This area includes three distinctive areas of Puget Sound in Washington, which includes the following counties: Challam, Jefferson, King, Kitsap, Island, Mason, Pierce, San Jan, Skagit, Snohomish, Thurston, and Whatcom (NOAA, 2006).

Killer whales require open ocean waters that are free of obstacles (NOAA, 2006). Concerns for the killer whales includes the taking of animals for aquarium purposes, the decline of the Chinook salmon population, increases in pollution, and boat traffic (WDFW, 2012c).

Birds

One endangered and five threatened bird species are federally listed for Washington as summarized in Table 8.1.6-7. The Marbled Murrelet *(Brachyramphus marmoratus)*, Northern Spotted Owl *(Strix occidentalis caurina)*, and the Western Yellow-billed Cuckoo *(Coccyzus americanus)* occur throughout Washington. The Short-tailed Albatross *(Phoebastria albatrus)*, Streaked Horned Lark *(Eremophila alpestris strigata)*, and the Western Snowy Plover *(Charadrius alexandrinus nivosus)* occur on or near the coast of Washington. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Table 8.1.6-7 is provided below.

Table 8.1.6-7: Federally Listed Bird Species of Washington

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Washington	Habitat Description
Marbled Murrelet	*Brachyramphus marmoratus*	T	Yes; in the western half of Washington.	Forages in marine waters and nests in large conifer trees throughout Washington.
Northern Spotted Owl	*Strix occidentalis caurina*	T	Yes; in areas west and east of the Cascades in Washington.	Older forested habitats in western Washington.
Short-tailed Albatross	*Phoebastria albatrus*	E	No	Marine habitats, coastal upwelling areas. Found in 4 counties along the coast of Washington.
Streaked Horned Lark	*Eremophila alpestris strigata*	T	Yes; in Gray's Harbor, Pacific, and Wahkiakum Counties in Washington.	Open grasslands in 6 counties near the coast in western Washington.
Western Snowy Plover	*Charadrius alexandrinus nivosus*	T	Yes; in Gray's Harbor and Pacific Counties, Washington.	Sparsely vegetated sandy beaches in Grays Harbor and Pacific Counties, on the coast of Washington.
Western Yellow-billed Cuckoo	*Coccyzus americanus*	T	No	Riparian forested habitat dominated by cottonwood and willow trees throughout Washington.

Source: (USFWS, 2015c)

[a] E = Endangered, T = Threatened

Marbled Murrelet. The marbled murrelet is a small, chubby seabird with a short neck. In breeding season, its upperparts are dark brown to blackish in color, with a mottled white belly and throat. In winter, its upperparts become gray, dark marks appear on the sides of its breast, and a white ring forms around its eye. The marbled murrelet was federally listed as threatened in 1992 (57 FR 45328 45337, October 1, 1992) (USFWS, 2015r). Critical habitat for this species was designated in 2011 (76 FR 61599 61621, October 5, 2011) in Washington, Oregon, and California (USFWS, 2011a). Regionally, this species is found in California, Oregon, and Washington. In Washington, it can be found in 27 counties in the western part of the state (USFWS, 2015r).

The marbled murrelet is a small diving seabird that feeds primarily on fish and invertebrates in near-shore marine waters. It spends most of its time on the ocean, roosting, and feeding, but moves inland to nest in old-growth forest stands. Nesting habitat is characterized by large trees with large branches or deformities for use as nest platforms. Larger, unfragmented stands of old-growth appear to be the highest quality habitat for marbled murrelet nesting. The primary threats to the marbled murrelet are habitat loss (primarily from logging), bycatch in gill net fisheries, and oil spills. (USFWS, 2011a)

Northern Spotted Owl. The northern spotted owl is a medium sized dark brown owl with light colored spots on its head and breast (USFWS, 2015t). The owl was federally listed as threatened in 1990 (55 FR 26114 26194, June 26, 1990). Critical habitat was designated in 2012 (77 FR 71875 72068, December 4, 2012) in California, Oregon and Washington including areas west and east of the Cascades (USFWS, 2012a). In Washington the northern spotted owl is found in 24 counties in the western half of the state (USFWS, 2015t).

The northern spotted owl generally prefers older forested habitats because they contain the required features for nesting, roosting, and foraging. Northern spotted owls are highly territorial and maintain large home ranges. They primarily prey on small mammals. Threats to this species include habitat loss which has occurred as a result of forest conversion, timber harvest, fires, and insect infestation and from the competition from the barred owl. (USFWS, 2012a)

Short-tailed Albatross. The short-tailed albatross is a large pelagic bird with long wings. It has a large hooked pink bill with a black border around the base. The short-tailed albatross is distinguished by its all white back (USFWS, 2000) (USFWS, 2015u). The short-tailed albatross was federally listed as endangered in 2000 (65 FR 46643 46654, July 31, 2000). No breeding habitat exists within Washington. The species uses the marine habitat along the coast for foraging. In Washington it is found in Clallam, Grays Harbor, Jefferson, and Pacific Counties, on the coast (USFWS, 2015u).

Short-tailed Albatross nest in isolated off shore islands that have flat or sloped ground and sparse or full ground vegetation. Females lay one egg per breeding season. They feed in marine waters off fish, squid, and crustaceans in areas coastal upwelling. Threats to the short-tailed Albatross include loss of nesting habitat, pollution, and incidental loss due to off-shore fishing. (USFWS, 2000)

Streaked Horned Lark. The streaked horned lark is a small, ground-dwelling bird that grows approximately 6 to 8 inches in length. It has a dark brown colored back, yellowish underparts, walnut brown back of the neck, and a yellow throat and eyebrow stripe. This subspecies can be distinguished from other horned larks by its smaller size, darker back coloring, and more yellow coloration beneath (ODFW, 2016). It has a short, thin bill, and a short neck and rounded head. It also has distinctive “black horns” which are feather tufts. This species was federally listed as threatened in 2013 (78 FR 61451 61503, October 3, 2013) (USFWS, 2015v). Critical habitat was also designated in 2013 (78 FR 61505 61589, October 3, 2013) in Grays Harbor, Pacific, and Wahkiakum Counties in Washington (USFWS, 2013c). This species is found in the Puget lowlands in Washington, the Washington coast and lower Columbia River islands, and the Willamette Valley in Oregon (ODFW, 2016). In Washington it is known to exist in six counties in the western part of the state (USFWS, 2015v).

It inhabits open spaces with no trees and few to no shrubs. It nests on the ground in areas with little vegetation that are dominated by grasses and herbaceous flowering plants. Its nesting habitat includes a broad range of environments, such as native prairies, coastal dunes, agricultural fields, wetland mudflats, edges of grass fields, pastures, airports, gravel roads, dredge deposition sites, and recently planted Christmas tree farms. Threats to the streaked horned lark include habitat loss and modification due to conversion to agriculture and industry, loss of natural disturbances such as fire and flooding, invasion of nonnative plants, and incompatible management practices. (ODFW, 2016)

Western Snowy Plover. The western snowy plover is a small shorebird, approximately 6 inches long. It has a thin, dark bill, white forehead, and eyebrow line, with black patches above the forehead and behind the eye. Its upper parts are pale brown to gray in color, its belly is white or buff colored, and it has darker patches on its shoulders and head. Its dark gray to black colored legs distinguish the western snowy plover from other plovers. The Pacific coast population breeds on coastal beaches from southern Washington down to southern Baja California, Mexico (USFWS, 2014d). The species was federally listed as threatened in 1993 (58 FR 12864 12874, March 5, 1993) (USFWS, 2015aq). In 2012 (77 FR 36727 36869, June 19, 2012), critical habitat was designated in Grays Harbor and Pacific Counties, Washington (USFWS, 2012b). In Washington, the western snowy plover can be found in Grays Harbor and Pacific Counties, on the coast (USFWS, 2015aq).

Its breeding and nesting habitat is above the high tide line on coastal beaches, sand spits, dune-backed beaches, sparingly vegetated dunes, beaches at the mouths of creeks and rivers, and salt pans at lagoons and estuaries. Nesting habitat occurs throughout its range, but could be separated by expanses of rocky shoreline. The main threat to the western snowy plover is its poor reproductive success due to human disturbance, predation, extreme weather, and the introduction of nonnative plants. Human disturbances to nesting sites, like walking, jogging, running pets, horseback riding, and vehicle use are big reasons for the decline in breeding sites and western snowy plover populations, resulting in abandonment of nest sites and reductions in nesting density and success. (USFWS, 2014d)

Yellow-billed Cuckoo (Western). The western yellow-billed cuckoo is a relatively large, long, and slim-bodied bird. The thick, down curved bill is mostly yellow in color and almost as long as the head. It has a flat head, thin body, long tail, with pointed swept back wings when in flight. It is warm brown in color above, and a clean whitish color below. It has a blackish face mask with a yellow ring around its eye (USFWS, 2015w). This shy, migrant bird winters in South America and breeds in the western U.S. The western yellow-billed cuckoo is considered a separate population from its eastern counterpart. Currently, the western yellow-billed cuckoo is only known to breed in Arizona, California, Colorado, Idaho, New Mexico, and Utah (Johnson, 2009). This species was federally listed as threatened in 2014 (79 FR 67154 67155, November 12, 2014). The western population occurs from the west coast to the Midwest. In Washington, the yellow-billed cuckoo is found in 38 counties throughout the state (USFWS, 2015w).

Preferred habitat consists of riparian forested habitat dominated by cottonwood and willow trees, and in particular contiguous stands of these tree species that exceed 25 acres in size. This species does not tend to breed in forested areas with minimal canopy cover and invasive species. Loss of suitable forested habitat along streams and rivers due to habitat fragmentation, invasion of invasive species, and conversion of land to other uses are considered the primary threats to this species. (Johnson, 2009) (USFWS, 2014e)

Fish

Three threatened fish species occur in Washington, and specific populations of two other fish species are either threatened or endangered, as summarized in Table 8.1.6-8. Hence, two of the five listed fish species are identified in Table 8.1.6-8 as both threatened and endagered. The Bull trout (*Salvelinus confluentus*) occurs in freshwater streams throughout Washington. The Chinook salmon (*Oncorhynchus tshawytscha*) occurs in fresh and marine waters including the Columbia River, Puget Sound, and the Snake River in Washington. The Chum salmon (*O. keta*) occurs in fresh and marine waters including the Hood Canal and Columbia River in Washington. The Sockeye salmon (*O. nerka*) occurs in fresh and marine waters including Ozette Lake and Snake River in Washington. The Steelhead trout (*O. mykiss*) occurs in fresh and marine waters including the Columbia River, Puget Sound, Snake River Basin, and the Upper Willamette River in Washington. The Dolly varden (*Salvelinus malma*) is a candidate char fish species that is proposed for listing as threatened (72 FR 69034 69106, December 6, 2007). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Washington is provided below.

Table 8.1.6-8: Federally Listed Fish Species of Washington

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Washington	Habitat Description
Bull Trout	*Salvelinus confluentus*	T	Yes; in 29 counties throughout Washington.	Freshwater streams in 38 counties throughout Washington.
Chinook Salmon – 5 ESU[99] populations	*Oncorhynchus tshawytscha*	T/E	Yes; four ESUs in western Washington and	Freshwater and marine habitats including the Upper Columbia spring-run (E), Lower Columbia River (T), Puget Sound (T),

[99] ESU: Evolutionarily Significant Unit

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Washington	Habitat Description
			one in central Washington.	Snake River spring/summer-run (T), and Snake River fall-run (T), Washington.
Chum Salmon – 2 populations	*Oncorhynchus keta*	T	Yes; for 2 ESUs in western Washington.	Freshwater and marine habitats including the Hood Canal and Columbia River in Washington.
Sockeye Salmon – 2 populations	*Oncorhynchus nerka*	E/T	Yes; in Clallam County, Washington.	Freshwater and marine habitats including Ozette Lake (T) and Snake River, Washington.
Steelhead Trout – 5 populations	*Oncorhynchus mykiss*	T	Yes; in western Washington.	Freshwater and marine habitats including designated populations in the Columbia River, Puget Sound, Snake River Basin, and the Upper Willamette River, Washington.

Source: (USFWS, 2015c)

[a] E = Endangered, T = Threatened

Bull Trout. The bull trout is a member of the Salmonidae family with an olive green to bronze colored back covered in pale yellow, orange, or salmon-colored spots. There are two forms of bull trout: resident, which spend their whole lives in the same stream; and migratory, which swim to larger bodies of water over the winter and then migrate back to smaller waters to spawn. Resident bull trout can grow up to 10 inches in length, while migratory bull trout can reach up to 35 inches and weigh up to 32 pounds. The bull trout was federally listed as threatened in 1998 (63 FR 31647 31674, June 10, 1998). (USFWS, 2015x)

Bull Trout Photo Credit: USFWS

Bull trout are found in western Canada, Idaho, Montana, Nevada, Oregon, and Washington. Streams and rivers in Montana and Idaho serve as the headwaters for this species. Bull trout populations are typically migratory, but not exclusively. Migratory bull trout spawn in smaller streams, and inhabit rivers and lakes during other portions of their lifecycle (USFWS, 2014f). In Washington, it can be found in 38 counties throughout the state (USFWS, 2015x). Critical habitat was designated in 2010 (75 FR 63898 64070, October 18, 2010) in Washington, Oregon, Nevada, Idaho, and Montana. In Washington, critical habitat is designated within 29 counties throughout the state (USFWS, 2010).

Similar to other salmonid species, bull trout have specific habitat requirements. They require cold water typically less than 12 degrees Celsius, good water quality, strong migratory corridor connectivity, stable and undisturbed stream channels, and clean gravel substrate for spawning. The greatest threats to this species include fish passage restrictions that lead to habitat fragmentation, impacts to water quality due to land management activities, overfishing, hybridization with other trout species, and the potential for increased water temperatures due to climate change. (USFWS, 2014f)

Chinook Salmon *(Lower Columbia River, Puget Sound, Snake River fall-run, Snake River spring/summer-run, and Upper Columbia spring-run ESUs).* The Chinook salmon is the largest of the Pacific salmon, averaging 40 pounds and 3 feet when full grown, but can be up to 120 pounds in weight. When at sea, it is blue-green in color on its back, with silver sides. It can be distinguished from the similar looking coho salmon by its larger size, small black spots on the tail, and black coloration along the base of the teeth. They spend approximately 3 months to 2 years in freshwater as juveniles, before migrating to estuarine habitats as smolts, and then to the ocean to feed and mature for approximately 2 to 4 years, before going back to the freshwater streams and rivers where they were born to mate and then die. Chinook prefer deeper and larger streams than ones used by other Pacific salmon. Adult female Chinook make a nest in a stream area that has suitable gravel type, water depth, and current. Chinook spawning areas have larger gravel and more water flow than other Pacific salmon spawning areas. In the U.S., this species occurs from the Bering Strait off of Alaska, south to Southern California. Globally, it also occurs along the coast of Siberia and south to Hokkaido Island, Japan (NOAA, 2015e).

Species of Chinook are divided into Evolutionarily Significant Units (ESU). Nine Chinook ESUs are listed for protection under the Endangered Species Act, five of which are located in Washington: the Lower Columbia River, Puget Sound, Snake River fall-run, Snake River spring/summer run and the Upper Columbia spring-run ESUs. Critical habitat was designated in Washington for the Upper Columbia spring-run, Lower Columbia River, Upper Willamette River, and the Puget Sound ESUs within their range in the western and central parts of the state (USFWS, 2015ad). Current threats to this species include human induced changes to habitats caused by poor forestry practices, dams, water diversions, and pollution (NOAA, 2015e).

Chum Salmon *(Hood Canal summer-run and Columbia River ESUs).* The chum salmon, also called dog salmon, is second only to the Chinook salmon in size, growing up to 3.6 feet and 45 pounds. Average weight is approximately 8 to 15 pounds. Its large canine-like fangs and bright coloration of spawning males, marked by a bold, jagged, reddish line on the front two-thirds of the body, and jagged black line on the back third, can distinguish this species. Females are not as striking during spawning. When in the ocean, both sexes are metallic greenish-blue in color along the back, and have black speckles. When they reenter fresh water, they develop a “tiger stripe” pattern of bold red and black stripes. Chum salmon migrate from the ocean back into the freshwater streams and rivers where they were born in order to mate and then die. Unlike most other species that spawn in fresh water, chum salmon form schools, probably to reduce predation. When spawning, it inhabits the lowermost reaches of rivers and streams, usually near streams, and typically within approximately 62 miles of the ocean. Almost immediately after hatching, juveniles migrate to estuarine and ocean waters, unlike other Pacific salmon. (NOAA, 2015f)

This species has the widest range of any Pacific salmon, extending along the shores of the Arctic Ocean, Korea, Japan, and into the far north of Russia. In the U.S., chum salmon occur as far south as Tillamook Bay on the northern Oregon coast, and all the way north through Alaska. Species of chum salmon are divided into ESUs. Two ESUs were federally listed as threatened in 1999 (64 FR 41835 41839, August 2, 1999), both which are located in Washington: the Hood Canal summer run and the Columbia River ESUs. Critical habitat was designated in 2000 (65 FR 7764 7787, February 16, 2000) in stream channels in Oregon and Washington for these threatened ESUs. Current threats to this species include human induced changes to habitats caused by poor forestry practices, dams, water diversions, and pollution (NOAA, 2015f) (USFWS, 2015ae).

Sockeye Salmon *(Ozette Lake and Snake River ESUs). On average,* sockeye salmon weigh eight pounds and are three feet long. In the ocean, sockeye salmon are bluish black with silver sides. However, during spawning adults turn bright red. Sockeye salmon are anadromous fish, migrating from the sea to spawn in freshwater. The majority of sockeye salmon spawn in or near lakes where juveniles rear before returning to the ocean (NOAA, 2015g).

Species of sockeye salmon are divided into ESUs. Two ESUs are listed for protection under the Endangered Species Act, both of which are located in Washington. These are the Ozette Lake and Snake River ESUs (64 FR 41835 41839 August 2, 1999). As of 2000, critical habitat has been designated to all lake and river reaches accessible to Ozette Lake Salmon in Washington specifically Clallam County (65 FR 7764 7787 February 16, 2000). Current threats to this species include human induced changes to habitats caused by poor forestry practices, dams, water diversions, and pollution (NOAA, 2015g).

Steelhead Trout *(Lower Columbia River, Puget Sound, Snake River Basin, Upper Columbia River, and Upper Willamette River ESUs).* Steelhead trout are a part of the taxonomic family Salmonidae. They are typically dark-olive in color with shading to silvery-white on the underside (NOAA, 2015h). Steelhead trout are born in fresh water streams and migrate to the ocean where most of their growth occurs. Steelhead then return to the rivers of their birth to spawn. Unlike Pacific salmon, steelhead do not necessarily die after spawning and are able to spawn more than once (USFWS, 2015af). Species of steelhead are divided into ESUs. Twelve steelhead ESUs are listed for protection under the Endangered Species Act, five of which are located in Washington. The five in Washington include the Lower Columbia River, Puget Sound, Snake River Basin, Upper Columbia River, and Upper Willamette River ESUs. As of 2005, stream channels and lakes have been designated as critical habitat for steelhead trout in California, Idaho, Oregon, and Washington (USFWS, 2015af).

Steelhead trout can handle a wide range of water temperatures. Spawning habitat consists of gravel substrates that are free of excessive silts. Current threats to this species include human induced changes to habitats caused by poor forestry practices, dams, water diversions, and pollution (NOAA, 2015h).

Reptiles

Two endangered and one threatened reptile species are federally listed for Washington as summarized in Table 8.1.6-9. The Green Sea Turtle *(Chelonia mydas)*, Leatherback Sea Turtle *(Dermochelys coriacea)*, and the Loggerhead Sea Turtle *(Caretta caretta)* can occasionally be found off the coast of Washington. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Washington is provided below.

Table 8.1.6-9: Federally Listed Reptile Species of Washington

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Washington	Habitat Description
Green Sea Turtle	*Chelonia mydas*	T	No	Tropical and subtropical oceans near islands and along continental coasts. Rarely found off the coast of Washington.
Leatherback Sea Turtle	*Dermochelys coriacea*	E	Yes; along the coast of Washington.	Tropical and temperate regions of the Atlantic, Pacific and Indian Oceans. Rarely found off the coast of Washington.
Loggerhead Sea Turtle	*Caretta caretta*	E	No	Open sea environment. Occasional sightings off the Washington coast.

Source: (USFWS, 2015c)

[a] E = Endangered, T = Threatened

Green Sea Turtle. The green sea turtle occurs throughout tropical and subtropical oceans and is among the largest of the hard-shelled sea turtles growing to as much as 440 pounds and 4 feet in length (USFWS, 2015ak) (NOAA, 2015i). The breeding populations in Florida were listed as endangered, whereas all other populations, including Washington, were listed as threatened in 1978 (43 FR 32800 32811, July 28, 1978). In the eastern North Pacific, they primarily occur south of San Diego and rarely extend northward. Green sea turtles are rarely recorded in Washington (WDFW, 2012d). NMFS has designated the waters surrounding Culebra, Mona, and Monito Islands, Puerto Rico, as critical habitat necessary for the continued survival and recovery of green sea turtles, but no critical habitat is located in Washington (USFWS, 2015ak).

Green sea turtles are found in the shallow waters (except during migration) of shoals, bays, lagoons, reefs, and inlets, often where submerged aquatic vegetation exists. They use three primary types of habitat – beaches for nesting, open ocean convergence zones, and coastal areas for bottom feeding. Hatchlings consume both plants and animals, while adult green sea turtles are herbivorous feeding on seagrasses and algae (NOAA, 2015i). Breeding takes places in subtropical to tropical oceans every two, three, or four years between June and September, with peak nesting in June and July (USFWS, 2015ak) (NOAA, 2015i). Hatching usually occurs at night, and many green sea turtle hatchlings seek refuge and food in masses of floating sea plants (USFWS, 2015ak). Current threats include disease, loss or degradation of nesting habitat, disorientation of hatchlings by lighting, nest predation, marine pollution, watercraft strikes, and incidental take from channel dredging and commercial fishing operations (NOAA, 2015j) (NOAA, 2015i).

Leatherback Sea Turtle. The leatherback sea turtle is the deepest-diving and most wide-ranging sea, growing 4 to 8 feet long and weighing 500 to 2,000 pounds (USFWS, 2015r). The leatherback sea turtle was listed as endangered in 1970 (35 FR 8491 8498, June 2, 1970) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.) (USFWS, 2015ao). The leatherback sea turtle is capable of tolerating a wide range of water temperatures; hence its wide global distribution, including parts of the Atlantic, Pacific, and Indian Oceans. In the eastern Pacific, loggerheads can be found as far north as Alaska, and as far south as Chile (USFWS, 2015ao). Along the U.S. west coast, sightings have been reported from the coasts of Washington and Oregon; however, these sightings are rare (WDFW, 2012d). Critical habitat was established in 2012 along the coasts of California, Oregon, and Washington (NMFS, 2012).

Leatherback Sea Turtle Photo Credit: USFWS

The preferred habitat for this species includes open oceans but can also occur in coastal waters. The leatherback sea turtle diet consists of jellyfish, salps (a transparent barrel-shaped tunicate[100]), and other soft-bodied animals. This species will forage in both coastal waters and the open sea environment (NOAA, 2015k). For reproduction the female leatherback sea turtles nest at 2 to 3 year intervals during the months of March to July. Nest building occurs during the night and each turtle will nest up to 11 nest per nesting season (USFWS, 2015r). Leatherbacks do not nest on Washington beaches (WDFW, 2012d). Current major threats to the species include harvesting of turtles and their eggs, hunting, incidental capture in fishing gear, and consumption of plastics that were mistaken for jellyfish (NOAA, 2015k). (NMFS, 2012)

Loggerhead Sea Turtle. The loggerhead sea turtle is a smaller sea turtle that can grow to an average length of 3 feet and weight of 250 pounds. This species has a reddish-brown carapace and flippers, and is characterized by its large head (USFWS, 2015s). The loggerhead sea turtle was initially listed as threatened throughout its range in 1978 (43 FR 32800 32811, July 28, 1978); but by 2011 nine different distinct populations were listed and the North Pacific Ocean population was listed as endangered (76 FR 58868 58952, September 22, 2011) (USFWS, 2015ap). In the eastern Pacific Ocean, loggerhead sea turtles have been found from Alaska to Chile. There have been occasional sightings off the coasts of Washington and Oregon, but most sightings off the west coast of the U.S. are of juveniles off the coast of California (NOAA, 2014).

The preferred habitat for the loggerhead sea turtle is the open sea environment, but they also occur in inshore area such as salt marshes, creeks, bays, and lagoons. Open beaches are the

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

preferred location for nesting along the coast and coral reefs and rocky places are the preferred feeding areas for the loggerhead sea turtles (NOAA, 2014). Current threats to the logger head sea turtle include incidental captures in fishing gear, directed harvesting of eggs, and loss and degradation of habitats (NOAA, 2014) (USFWS, 2008).

Amphibians

One threatened amphibian species is federally listed for Washington as summarized in Table 8.1.6-10. The Oregon Spotted Frog *(Rana pretiosa)* is found in wetlands in western and central Washington. Information on the habitat, distribution, and threats to the survival and recovery of this species in Washington is provided below.

Table 8.1.6-10: Federally Listed Amphibian Species of Washington

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Washington	Habitat Description
Oregon Spotted Frog	*Rana pretiosa*	T	No	Wetlands associated with lakes, ponds, or slow moving streams. Found in 21 counties in western and central Washington.

Source (USFWS, 2015c)

[a] T = Threatened

Oregon Spotted Frog. The Oregon spotted frog is a medium-sized frog, growing from 1.7 to 4 inches in body length, and is the most aquatic native frog in the Pacific Northwest. It gets its name from the black spots that cover its head, back, sides, and legs. Juveniles are usually brown in color, but can sometimes be olive green in color on the back, and white or cream colored with reddish pigments under its legs and abdomen. Adults are brown to reddish brown in color, and become redder with age. Red coloring also increases on the abdomen with age, with under the legs becoming a vivid orange-red. This red coloring distinguishes the Orange spotted frog other native frogs (ODFW, 2014). The Oregon spotted frog was federally listed as threatened in 2014 (79 FR 51657 51710, August 29, 2014). This species ranges from southwestern British Columbia, to south-central Washington, to the east side of the Cascades Range and the upper Klamath River basin in Oregon. In Washington it is found in 21 counties in the western and central parts of the state (USFWS, 2014g).

It inhabits emergent wetlands in or near perennial bodies of water such as springs, ponds, lakes, wetlands, slow-moving streams, irrigation canals, or roadside ditches. It needs areas of shallow water for eggs and tadpoles, and plentiful aquatic vegetation for basking and cover (USFWS, 2014g). Threats to the Oregon spotted frog include habitat loss due to changes in hydrology and water quality, development, and livestock overgrazing; invasion of nonnative plants; succession of plant communities from marsh to meadow habitat; and the introduction of exotic predators such as bullfrogs and nonnative fishes (ODFW, 2014).

Invertebrates

One endangered and one threatened invertebrate species is federally listed for Washington as summarized in Table 8.1.6-11. The Taylor's checkerspot butterfly *(Euphydryas editha taylori)* is found in the western part of Washington. The Oregon silverspot butterfly (*Speyeria zerene hippolyta*) is found along the coast on the Long Beach Penninsuala in Washington. The Island marble butterfly (*Euchloe ausonides insulanus*) has been identified as a candidate species in Washington. Information on the habitat, distribution, and threats to the survival and recovery of this species in Washington is provided below.

Table 8.1.6-11: Federally Listed Invertebrate Species of Washington

Common Name	Scientific Name	Federal Status a	Critical Habitat in Washington	Habitat Description
Oregon Silverspot Butterfly	*Speyeria zerene hippolyta*	T	Not in Washington	Long Beach Penninsula in Washington.
Taylor's Checkerspot	*Euphydryas editha taylori*	E	Yes; in Thurston County, Washington.	Grasslands in Clallam, Island, Pierce, and Thurston Counties, western Washington.

Source: (USFWS, 2015c)

[a] E = Endangered

Oregon Silverspot Butterfly. According to USFWS, "The Oregon silverspot is a medium-sized, orange and brown butterfly with black veins and spots on the dorsal (upper) wing surface, and a yellowish submarginal band and bright metallic silver spots on the ventral (under-side) wing surface. This subspecies is distinguished from other subspecies of silverspot butterflies by a somewhat smaller size and darker coloration at the base of the wings. These are morphological adaptions for survival in a persistently windy and foggy environment. The forewing length averages about 27 millimeters (1 inch) for males and 29 millimeters (1.1 inch) for females. Hydaspe fritillary (Speyeria hydaspe), a related species found in adjacent habitats can be distinguished by the cream, rather than silver, colored spots of the ventral wing surface." (USFWS, 2001a)

In Washington, the Oregon silverspot is found in the Long Beach peninsula. According to USFWS, "The most important feature of the habitat of the Oregon silverspot is the presence of the early blue violet. This plant is normally the only species on which the Oregon silverspot can successfully feed and develop as larva. However, in the laboratory the butterflies will accept other species of violets, and there is evidence that some individuals on Mount Hebo are using another species of violet. This plant is part of the salt-spray meadow vegetation and is an obligatory component of the butterfly's habitat. Other features of optimum habitat include moderate grass cover, including red fescue (Festuca rubra) used as a shelter for larvae, and a mixture of herbaceous plants such as California aster (Aster chilensis) used for nectaring by adults. Apparently the more inland meadow sites occupied by related subspecies of silverspots are not accessible to Oregon silverspots." (USFWS, 2001a)

Taylor's Checkerspot. The Taylor's checkerspot butterfly is a medium sized butterfly with distinctive colorfully checkered pattern of orange to red, black, and cream with a wing span of 2.25 inches (WDFW, 2012e). The Taylor's checkerspot butterfly was federally listed as endangered in 2013 (78 FR 61451 61503, October 3, 2013). Approximately 1,900 acres of critical habitat was designated in 2013 for the Taylor's checkerspot butterfly in Oregon and Washington (78 FR 61505 61589, October 3, 2013). In Washington, critical habitat exists entirely in Thurston County. The Taylor's checkerspot butterfly is found in Clallam, Island, Pierce, and Thurston Counties in western Washington (USFWS, 2015ah).

Taylor's checkerspot butterfly prefers grassland habitats. Females lay eggs on specific host plants which include harsh paintbrush, marsh speedwell, and American brooklime. When caterpillars emerge they rely on these plants for food. In the summer the caterpillars go into their dormant state called a diapause. They wake in the early spring to feed and then form their chrysalis before becoming an adult butterfly. Threats to this species include habitat loss due to agricultural conversion and urban development (USFWS, 2015ah).

Plants

Three endangered and eight threatened plant species are federally listed for Washington as summarized in Table 8.1.6-12. The Ute Ladies'-tresses *(Spiranthes diluvialis)* occurs in north-central Washington. The golden paintbrush *(Castilleja levisecta)* occurs in western Washington. The water howellia *(Howellia aquatilis)* occurs in western and eastern Washington. The Umtanum desert buckwheat *(Eriogonum codium)* and the white bluffs bladderpod *(Physaria douglasii ssp. tuplashensis)* occur in southern Washington. The Bradshaw's desert-parsley *(Lomatium bradshawii)*, Kincaid's lupine *(Lupinus sulphureus ssp. kincaidii)*, and the Nelson's checker-mallow *(Sidalcea nelsoniana)* occur in southwestern Washington. The showy stickseed *(Hackelia venusta)* and the Wenatchee Mountains checkermallow *(Sidalcea oregana var. calva)* occur in central Washington. The Spalding's catchfly *(Silene spaldingii)* occurs in east-central and southeastern Washington. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Washington is provided below.

Table 8.1.6-12: Federally Listed Plant Species of Washington

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Washington	Habitat Description
Bradshaw's Desert-parsley	*Lomatium bradshawii*	E	No	Seasonally saturated or flooded prairies near rivers, streams, and creeks. Found in Clark County, southwestern Washington.
Golden Paintbrush	*Castilleja levisecta*	T	No	Upland prairies on generally flat grasslands with glacial outwash. Found in Thurston and San Juan Counties in western Washington.
Kincaid's Lupine	*Lupinus sulphureus* ssp. *kincaidii*	T	Yes; in Lewis County, Washington.	Native upland prairie lands dominated by red fescue and/or Idaho fescue. Found in Lewis County, southwestern Washington.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Washington	Habitat Description
Nelson's Checker-mallow	*Sidalcea nelsoniana*	T	No	Swales and meadows with wet depressions. Found in Cowlitz and Lewis Counties in southwestern Washington.
Showy Stickseed	*Hackelia venusta*	E	No	Unvegetated steep slopes of open areas of ponderosa pine forests. Found in eight counties of central Washington.
Spalding's Catchfly	*Silene spaldingii*	T	No	Open, mesic[101] grasslands or sagebrush-steppe communities. Found in five counties in east-central and southeastern Washington.
Umtanum Desert Buckwheat	*Eriogonum codium*	T	Yes; 344 acres in Benton County, Washington.	Basalt ridges in the Columbia River Formation. Found in Benton County, in southern Washington.
Ute Ladies'-tresses	*Spiranthes diluvialis*	T	No	Wetlands, wet meadows, and swales, near perennial streams or lakes with vegetation that is not overly dense. Found in Chelan, Douglas, and Okanogan Counties, in north-central Washington.
Water Howellia	*Howellia aquatilis*	T	No	Wetlands formed by glacial potholes which consist of wet conditions during winter snowmelt and spring rains, and dry conditions by late summer. Found in Clark, Pierce, Spokane, and Thurston Counties in western and eastern Washington.
Wenatchee Mountains Checkermallow	*Sidalcea oregana* var. *calva*	E	Yes; 6,135 acres of Chelan County, Washington.	Wet meadows. Found only in the Wenatchee Mountains of Chelan and Kittitas Counties, central Washington.
White Bluffs Bladderpod	*Physaria douglasii ssp. tuplashensis*	T	Yes; 2,033 acres of Franklin County, Washington.	Dry vertical slopes with sparse vegetation. Found in Franklin County, southern Washington.

Source: (USFWS, 2015c)

[a] E = Endangered, T = Threatened

Bradshaw's Desert-parsley. Bradshaw's desert-parsley is a perennial herb in the parsley family that can reach up to 20 inches in height. The yellow flowers are small and grouped into asymmetrical umbels.[102] It has a long and slender taproot with a stem below the ground (WNHP, 2011b). The Bradshaw's desert-parsley was federally listed as endangered in 1988 (53 FR 38448 38451, September 30, 1988). Regionally, this species is found from southwest Washington to the Willamette Valley of Oregon. In Washington, it can be found in Clark County, in the southwestern part of the state (USFWS, 2015ar).

[101] Mesic: "Soil condition that is medium-wet." (USEPA, 2016a).
[102] Umbels — consists of a number of short flower stalks, which spread from a common point (USEPA, 2016a).

The Bradshaw's desert-parsley is found along rivers and seasonally saturated or flooded prairies. Soils in these locations are dense, heavy clays with slow permeability. Threats to this species include habitat degradation and loss due to residential and industrial development, agricultural conversions, and water diversion that has changed the hydrology of preferred habitat environments. (WNHP, 2011b)

Golden Paintbrush. The golden paintbrush is a perennial herb in the figwort or snapdragon family. Several stems erect to "creeping" at the base and give off the appearance of multiple plants. It can grow up to 12 inches tall and is covered in soft, sticky hairs with brilliant yellow flowers. The golden paintbrush was federally listed as threatened in 1997 (62 FR 31740 31748, June 11, 1997). Regionally, this species is found in Oregon and Washington. In Washington, it can be found in Thurston and San Juan Counties in the western part of the state. (USFWS, 2015as)

The golden paintbrush occurs primarily in upland prairies on generally flat grasslands with glacial outwash. Threats to this species include habitat loss from agricultural conversion, residential development, and fire suppression. (WNHP, 2011c)

Kincaid's Lupine. The Kincaid's lupine is a low growing perennial in the pea or legume family reaching a height of 30 inches. It produces a cluster of whitish-purplish to tan flowers (WNHP, 2011d). Kincaid's lupine was federally listed as threatened in 2000 (65 FR 3875 3890, January 25, 2000). Critical habitat was designated in 2006 in Douglas County, Oregon, and Lewis County, Washington (71 FR 63862 63977, October 30, 2006). Regionally, this species is found west of the Cascades in Oregon and Washington. In Washington, it can be found in Lewis County in the southwestern part of the state (USFWS, 2015al).

Kincaid's lupine is typically found in native upland prairie lands dominated by red fescue and/or Idaho fescue. The upland prairies are dry, open, grasslands with well drained soils. Threats to this species include habitat loss from agricultural conversion, urban development and the use of herbicides. (WNHP, 2011d)

Nelson's Checker-mallow. Nelson's checker-mallow is a perennial herb growing from 1.3 to 4.2 feet. Flowering stems are moderately branched with tall lavender to deep pink flowers. Nelson's checker-mallow was federally listed as threatened in 1993 (58 FR 8235 8243, February 12, 1993). Nelson's checker-mallow can be found from Oregon north to Washington. In Washington, it is found in Cowlitz and Lewis Counties in the southwestern part of the state. (USDA, 2010)

Its preferred habitat includes wetland prairie and emergent herbaceous wetlands. It can be found in swales and meadows with wet depressions, or along streams which all contain seasonally wet soils. Threats to this species include habitat loss and degradation from agricultural conversion, urban development, stream alteration, and fire suppression. (WNHP, 2011e)

Showy Stickseed. The showy stickseed is a short, perennial plant, growing from 8 to 16 inches in height. It forms 5-lobed, white flowers (USFWS, 2011b). The showy stickseed was federally listed as endangered in 2002 (67 FR 5515 5525, February 6, 2002). This species is only found in eight counties of central Washington (USFWS, 2015y).

Showy stickseed grows on steep slopes composed of well drained granitic sands and broken rocks on the east slope of the central Cascade Mountains of Washington at elevations of 1,600 to 2,500 feet. It is found growing in openings of ponderosa pine forests. Threats to this species include fire suppression and invasion by non-native species. (USFWS, 2011b)

Spalding's Catchfly. The Spaulding's catchfly is a perennial[103] herbaceous plant of the carnation family that can grow up to 30 inches in height and flowers from July to August. The species was federally listed as threatened in 2001 (66 FR 51597 51606, October 10, 2001). This plant gets its name because it is "covered in dense sticky hairs that frequently trap dust or insects" (USFWS, 2007b). Its range includes Idaho, Montana, Oregon, and Washington. In Washington, the species is found in the Palouse Grasslands in southeastern Washington; the Channeled Scablands in east-central Washington and the Canyon Grasslands along major river systems in Washington (USFWS, 2015z). In Washington, the species can be found in five counties including Adams, Asotin, Lincoln, Spokane, and Whitman (USFWS, 2015z).

Suitable habitat for this species includes "open, mesic[104] grasslands or sagebrush-steppe communities" within valleys and along drainages, and occasionally open pine forests. Typically, this species is associated with rough and Idaho fescues, Nelson's and Richard's needlegrasses, and bluebunch wheatgrass. Threats to this species include competition with nonnative invasive plants, fire suppression, small population sizes, livestock grazing and trampling, land conversion, climate change, insect damage, disease, and off-road vehicle use. (USFWS, 2007b)

Umtanum Desert Buckwheat. The Umtanum desert buckwheat is a long-lived, woody perennial plant that forms low mats. It flowers in May to August with thin, white, woolly flowers that have lemon yellow colored midribs with a yellow greenish base (WNHP, 2011f). The Umtanum desert buckwheat was federally listed as threatened in 2013 (78 FR 23983 24005, April 23, 2013). Also in 2013, 344 acres of critical habitat was designated in Benton County, Washington (78 FR 76995 77005, December 20, 2013). The species is only known to occur in Benton County, southern Washington (USFWS, 2015aa).

Umtanum desert buckwheat plants are only found on soils over exposed basalt on ridges overlooking the Columbia River. A major threat to the Umtanum desert buckwheat is loss from fires; natural or human induced. Fires also promote the invasion of non-native species to an area. Trampling due to humans disturbance from off road vehicles and recreational activities also has an impact on this species. (WNHP, 2011f)

Ute Ladies'-tresses. The Ute ladies'-tresses is a perennial orchid that grows up to 24 inches in height and typically flowers from early August to early September. The species occurs in Colorado, Idaho, Montana, Nebraska, Nevada, Utah, Washington, and Wyoming. In Washington, it can be found in Chelan, Douglas and Okanogan Counties, in the north-central part of the state (USFWS, 2015ab).

[103] 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)." (USEPA, 2016a).
[104] Mesic: "Soil condition that is medium-wet" (USEPA, 2016a).

Suitable habitat for this species includes wetlands, wet meadows, and swales[105] near perennial streams or lakes with vegetation that is not overly dense. Threats to this species include urbanization, agriculture, recreation, grazing, and invasion by nonnative species. (MFWP and MNHP, 2015) (USFWS, 1995)

Water Howellia. The water howellia is an aquatic, winter annual ranging from 4 to 24 inches in height that flowers in July to August. It was federally listed as threatened in 1994 (59 FR 35860 35864, July 19, 1994). Regionally, this species is found in California, Idaho, Montana, Oregon, and Washington. In Washington, it can be found in Clark, Pierce, Spokane, and Thurston Counties in the western and eastern parts of the state. (USFWS, 2015ac)

Suitable habitat for this species consists of wetlands formed by glacial potholes with a varied hydrologic regime,[106] consisting of wet conditions during winter snowmelt and spring rains, and dry conditions by late summer (USFWS, 2015ac). This plant is typically submerged or floating in water (USFWS, 1996). Important wetland habitat is often surrounded by deciduous[107] forest. The primary threats to this species and its habitat include timber harvesting, livestock grazing, invasion of nonnative invasive plants, and human-induced habitat conversion from increased urbanization, agriculture, and flood control measures (MFWP and MNHP, 2015) (USFWS, 1996).

Wenatchee Mountains Checkermallow. The Wenatchee Mountains checker-mallow is a perennial herb that forms a stout taproot which is branched at the crown. It consists of stalked flowers along a single stem that have light to deep pink petals (WNHP, 2011g). The Wenatchee Mountains checker-mallow was federally listed as endangered in 1999 (64 FR 71680, December 22, 1999) (USFWS, 2015an). Critical habitat was designated in 2001 (66 FR 46536, September 6, 2001) in approximately 6,135 acres of Chelan County, Washington (USFWS, 2015an) (USFWS, 2001b). This species is found only in the Wenatchee Mountains of Chelan and Kittitas Counties, central Washington (USFWS, 2015an).

The Wenatchee Mountains checker-mallow is found between elevations ranging from 1,600 to 3,300 feet in the Wenatchee Mountains. The species is typically found in meadows that have surface waters or saturated upper soils. However, they may also be found in open conifer stands dominated by ponderosa pine and Douglas-fir when these areas are characterized by moist soils. Threats to the Wenatchee Mountains checker-mallow include habitat destruction from natural events such as wildfires and agricultural and residential development. (WNHP, 2011g)

White Bluffs Bladderpod. The white bluffs bladderpod is a low-growing, herbaceous, perennial plant with a sturdy tap root with a dense rosette of broad gray-green leaves. It flowers in May through July with showy yellow flowers on relatively short stems (WNHP, 2011h). The white

[105] Swale: "A swale, sometimes called a biofilter, is a grass-lined channel that is designed to convey stormwater in shallow flow. Pollutant removal is accomplished through filtration through the vegetation and swales are frequently designed to allow for infiltration of stormwater" (USEPA, 2016a).
[106] Hydrologic regime: "The system that describes the occurrence, distribution, and circulation of water on the earth and between the atmosphere" (USEPA, 2016a).
[107] Deciduous: "Plants having structures that are shed at regular intervals or at a given stage in development, such as trees that shed their leaves seasonally" (USEPA, 2016a).

bluffs bladderpod was federally listed as threatened in 2013 (78 FR 23983 24005, April 23, 2013). Also in 2013, 2,033 acres of critical habitat was designated in Franklin County, Washington (78 FR 76995 77005 December 20, 2013). The plant is only found in Franklin County, southern Washington (USFWS, 2015ai).

White bluffs baldderpod is found in dry areas with very little vegetation cover. It is restricted to near-vertical exposures consisting of weathered, cemented, alkaline, calcium carbonate soils. Threats to this species include human activities such as off road vehicles and recreational activities. Slope failures from also result in loss to the species (WNHP, 2011h).

8.1.7. Land Use, Recreation, and Airspace

8.1.7.1. Definition of the Resources

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

Land Use and Recreation

Land use is defined as “the arrangements, activities, and inputs people undertake in a certain land cover type to produce, change, or maintain it” (Di Gregorio & Jansen, 1998). A land use designation can include one or more pieces of land, and multiple land uses may occur on the same piece of land. Land use also includes the physical cover, observed on the ground or remote sensing and mapping, on the earth’s surface; land cover includes vegetation and manmade development (USGS, 2012c).

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

Descriptions of land uses are presented in three primary categories: forest and woodlands, agricultural, and developed. Descriptions of land ownership are presented in four main categories: private, federal, state, and tribal. Descriptions of recreational opportunities are presented in a regional fashion, highlighting areas of recreational significance within 12 identified regions.

Airspace

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

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

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

8.1.7.2. Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, summarizes numerous federal environmental laws and regulations that, to one degree or another, may affect land use in Washington. However, local county, city, and village laws and regulations govern most site-specific land use controls and requirements. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities. The Short Course on Local Planning Guidebook is the current state-level guidance for land use planning in Washington (Washington Department of Commerce, 2012).

Because federal laws govern the Nation's airspace, there are no specific Washington state laws that would alter the existing conditions relating to airspace for this PEIS. Title 14 Aeronautics of the Revised Code of Washington (RCW) addresses aviation for the state (Washington State Legislature, 2015b).

8.1.7.3. Land Use and Ownership

For the purposes of this analysis, Washington is classified into primary land use groups based on coverage type as forest and woodlands, agricultural, developed land, and public land/surface water/other land covers. Land ownership within Washington has been classified into four main categories: private, federal, state, and tribal.

Land Use

Table 8.1.7-1 identifies the major land uses by coverage type in Washington. Forest and woodlands is comprised of the largest portion of land use with 46 percent of Washington's total land occupied by this category (Table 8.1.7-1 and Figure 8.1.7-1). Agricultural land is the second largest area of land use with about 20 percent of the total land area. As the third largest category, semi-desert areas accounts for approximately 12 percent of the total land area (USGS, 2011).

Table 8.1.7-1: Major Land Use in Washington by Coverage Type

Land Use	Square Miles	Percent of Land
Forest and Woodland	30,400	46.0%
Agricultural Land	13,355	20%
Semi-Desert	7,728	12%
Shrubland and Grassland	4,400	7%
Developed Land	2,041	3%
Other	8,552	13%

Source: (USGS, 2011)

Forest and Woodland

Forest and woodland areas can be found in most regions of the state. The largest concentrations are in the northeast region, the Cascade Mountain Range in western Washington, and the coastal range. Forest and woodlands have multiple uses and are owned and managed by various federal and state agencies and private landowners. State Forests account for about 975 square miles of state land and are comprised of 17 state forests. State Forests are managed by the Washington Department of Natural Resources. Some of these lands are used to generate revenues thorough timber sales or other revenue generating activities. The revenue generated from these activities is contributed to the state general fund and earmarked for education. The state forests also provide a variety of recreation opportunities and facilities (Washington State Department of Natural Resources, 2015f). Approximately 44 percent of Washington's total forestland, is owned collectively by private landowners such as families, individuals, natural resource organizations, associations, industry, corporations, and American Indian tribes (USFS, 2010). The majority of private landowners hold on average less than 100 acres. About 80 percent of the private landowners use the forest for their primary residence (USFS, 2010). For additional information regarding forest and woodland areas, see section 8.1.6, Biological Resources and Section 8.1.8, Visual Resources. The U.S. Forest Service owns and manages 14,083 square miles of forest land in Washington. These lands are managed for multiple uses including restoration, water, timber, and recreation.

Semi-Desert

Land use within the semi-desert category in Washington includes wildlife management areas, wilderness and wilderness study areas, recreation, minerals development, and livestock grazing (BLM 2016). The majority of semi-desert areas occur within the central portion of the state

(Figure 8.1.7-1) and are managed by private land owners, the state, DOD, tribes, or the BLM (Figure 8.1.7-2).

Shrubland and Grassland

The largest concentrations of shrubland and grassland are located in mountain valleys, edges of forest and woodlands, and the transition between high and low elevations (Figure 8.1.7-1). Land use in these areas varies by location and includes both private and public land ownership (Figure 8.1.7-2). Some of the uses within this category include ranching, recreation, and wildlife preservation.

Agricultural Land

Agricultural land exists in every region of the state, with the largest concentrations in southeastern quarter of the state (Figure 8.1.7-1). Approximately 19 percent of Washington's total land area is classified as agricultural land (13,355 square miles). In 2012, there were 37,249 farms in Washington and 81 percent were owned and operated by small, family businesses, with the average farm size of 396 acres (USDA, 2014a). Some of the state's largest agricultural uses include apples, potatoes, hay, wheat, cherries, grapes, pears, blueberries, hops, and aquaculture (seafood). Other agricultural uses include cattle and calves, dairy, and bees (USDA, 2014b). For more information by county, access the USDA Census of Agriculture website (http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Washington/.

Developed Land

Developed land in Washington tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 8.1.7-1). Although only 2.9 percent of Washington land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 8.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates, as of 2010, and Figure 8.1.7-1 shows where these areas are located within the Developed land use category.

Table 8.1.7-2: Top Five Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Seattle	3,059,393
Spokane	387,847
Vancouver(OR/WA)	359,562
Kennewick/Pasco/Richland	210,975
Bremerton	198,979
Total Population of Metropolitan Areas	4,216,756
Total State Population (2014 estimate)	7,061,530

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

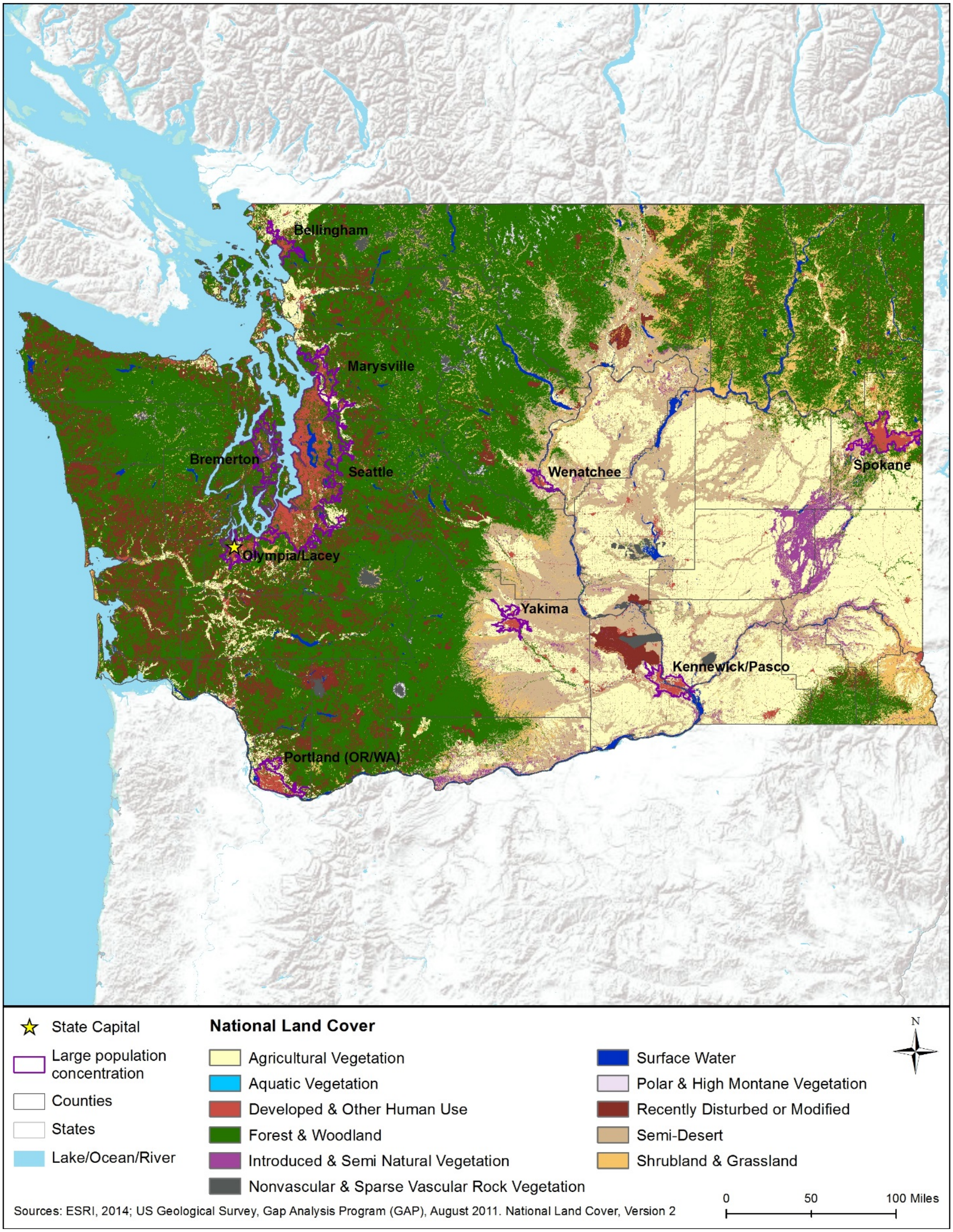


Figure 8.1.7-1: Major Land Use Distribution by Coverage Type

8.1.7.4. Land Ownership

Land ownership within Washington has been classified into four main categories: private, federal, state, and tribal (Figure 8.1.7-2).[108]

Private Land

Most of the private land in Washington falls under the land use categories of agricultural, forest and woodland, and developed (Figure 8.1.7-1). Highly developed, urban, metropolitan areas transition into suburban, agriculture, shrub, and woodland areas, which then transition into more wild and remote areas. Private land exists in all regions of the state.[109] (USGS, 2011)

Federal Land

The federal government manages 19,769 square miles (approximately 28 percent) of Washington land with a variety of land types and uses, including military bases, national wildlife refuges, national forests, national parks, monuments, historic sites, national laboratory, wilderness areas, national conservation lands, water projects, and dams. Seven federal agencies manage the majority of federal lands throughout the state (Table 8.1.7-3 and Figure 8.1.7-2). There may be other federal lands, but they are not shown on the map due to their small size relative to the entire state.[110]

Table 8.1.7-3: Federal Land in Washington

Agency	Square Miles	Representative Type
Department of Defense (DoD)	1,358	Military Bases, Facilities, Forts, Training Centers
U.S. Fish and Wildlife Service (USFWS)	541	National Wildlife Refuges
U.S. Forest Service	14,083	National Forests
National Park Service (NPS)	3,067	Parks, Historic Sites
Department of Energy	330	National Laboratory, Research Facilities
Bureau of Land Management	299	Wilderness Areas, National Conservation Lands
Bureau of Reclamation	91	Water Projects, Dams
Total	**19,769**	

Sources: (USGS, 2012d)

- The Department of Defense (DoD) owns and manages 1,358 square miles used for military bases and facilities, forts, and military training centers (DoD, 2014); the USFWS owns and manages 541 square miles consisting of 20 National Wildlife Refuges in Washington (USFWS, 2014h); the U.S. Forest Service owns and manages 14,083 square miles set aside as five National Forests and one National Monument including the Colville National Forest, Gifford Pinchot National Forest, Mount Baker-Snoqualmie National Forests, Mount St.

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

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

[110] Not all federal agency land is depicted in Figure 8.1.7-2 given the small size of some of the land acreage.

Helens National Volcanic Monument, Okanogan-Wenatchee National Forest, and the Olympic National Forest; the National Park Service (NPS) manages 3,067 square miles consisting of 15 officially designated NPS units, including National Historic Sites, National Recreation Areas and National Parks; the Department of Energy manages 330 square miles consisting of the Pacific Northwest National Laboratory and research facilities; the Bureau of Land Management manages 299 square miles consisting of a National Monument, Wilderness Areas, and National Conservation Lands; and the Bureau of Reclamation manages 91 square miles consisting of water projects and dams (USGS, 2012d) (USGS, 2014d).

State Land[111]

The Washington state government owns approximately 6,920 square miles of land comprised of state parks, wildlife areas, state forests, trust lands, and natural areas. The Department of Natural Resources manages 84 percent of state lands (Table 8.1.7-4) (Figure 8.1.7-2) (USGS, 2012d) (USGS, 2014d).

Table 8.1.7-4: State Land in Washington[a]

Representative Agency	Square Miles	Type
Washington State Parks	203	State Parks
Department of Fish and Wildlife	861	Wildlife Areas, Water Access Sites
Department of Natural Resources	5,840	State Forests, Trust Lands, Aquatic Lands, Natural Areas

Source: (USGS, 2012d)

[a] Acres are not additive due to overalapping boundaries of the State Forests, State Parks and Recreation Areas, and Wildlife Management areas.

- Washington State Parks manages 203 square miles consisting of about 140 state park units (Washington State Parks, 2015a); the Washington Department of Fish and Wildlife manages 861 square miles consisting of 33 wildlife areas and over 700 water access sites (WDFW, 2015d); and the Washington Department of Natural Resources manages 5,840 square miles consisting of state forests, trust lands, state-owned aquatic lands, and natural areas (Washington State Department of Natural Resources, 2015g) (USGS, 2012d) (USGS, 2014d).

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

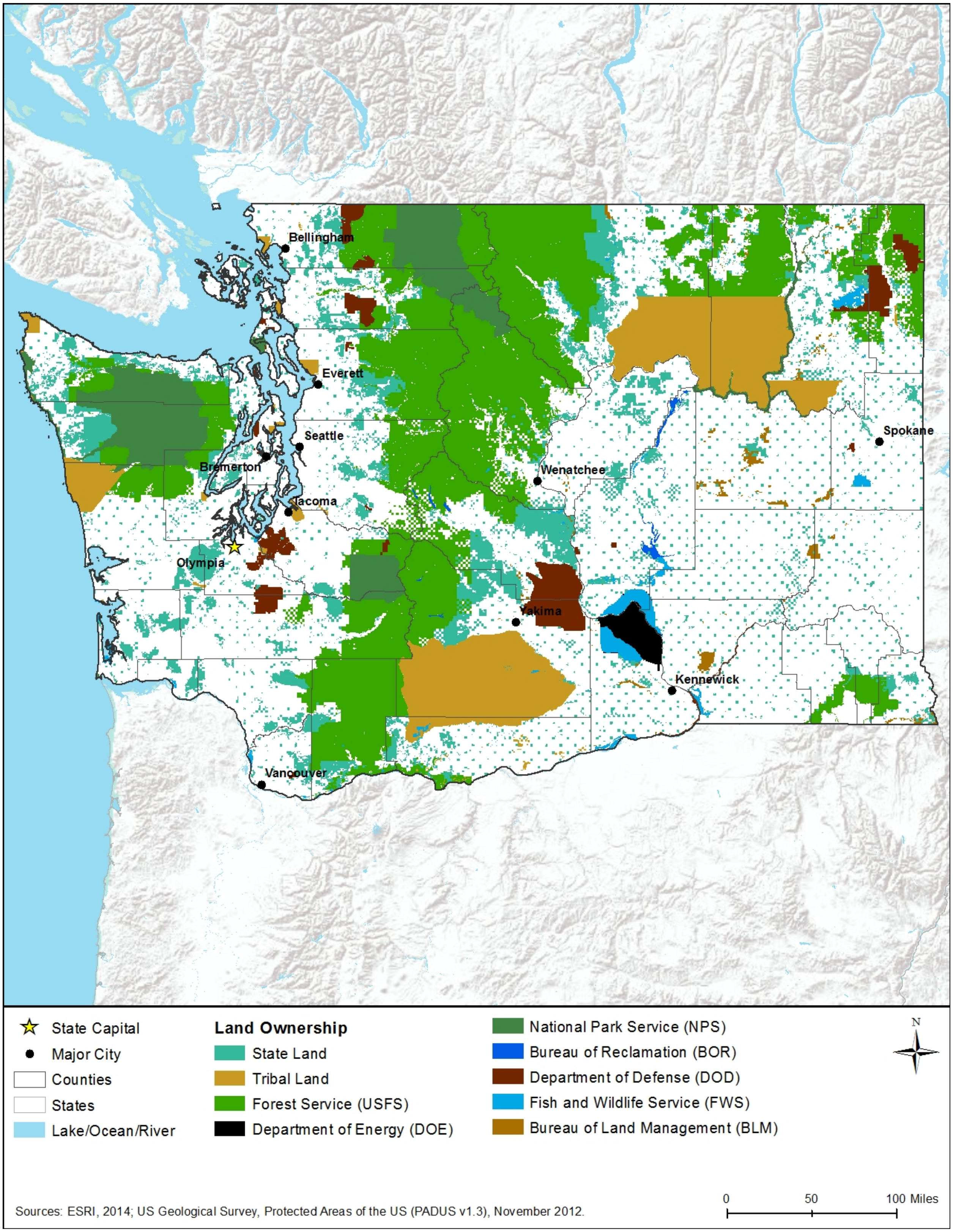


Figure 8.1.7-2: Land Ownership Distribution

Tribal Land

The Tribal land in Washington consists of 5,088.6 square miles, or seven percent of the total land within Washington.[112] These lands include 28 Indian Reservations located throughout the state (Table 8.1.7-5) (Figure 8.1.7-2) (USGS, 2012d) (USGS, 2014d). For additional information regarding tribal land, see Section 8.1.11, Cultural Resources.

Table 8.1.7-5: Indian Reservations and Other Land Holdings in Washington

Reservation Name	Square Miles
Chehalis Reservation	6.7
Colville Reservation	2,133.5
Cowlitz Indian Tribe, Washington	<0.2
Hoh Reservation	0.8
Jamestown Reservation	<0.1
Kalispel Reservation	7.2
Lower Elwha Reservation	0.7
Lummi Reservation	20.2
Makah Reservation (including Ozette)	43.7
Muckleshoot Reservation	5.7
Nisqually Reservation	8.1
Nooksack Reservation	4.2
Port Gamble Reservation	1.9
Port Madison Reservation	11.6
Puyallup Reservation	28.4
Quileute Reservation	1.5
Quinault Reservation	323.7
Samish Indian Tribe, Washington	<0.1
Sauk-Suiattle Reservation	<0.1
Shoalwater Reservation	1
Skokomish Reservation	8.1
Snoqualmie Tribe	<0.1
Spokane Reservation	246.7
Squaxin Island Reservation	2.3
Stillaguamish Reservation	<0.1
Swinomish Reservation	11.4
Tulalip Reservation	35.3
Upper Skagit Reservation	0.2
Yakama Reservation and Trust Land	2,185.5
Total	**5,088.6**

Sources: (USGS, 2012d)

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

8.1.7.5. Recreation

Washington is a state with diverse geography, including coastal cliffs, islands, and beaches, two mountain ranges with volcanoes, rainforests, and arid deserts. The state is visited for summer activities including kayaking, golfing, and mountain climbing as well as winter activities including downhill skiing, and snowboarding (Washington Tourism Alliance, 2015). On the community level, towns, cities, and counties provide an assortment of indoor and outdoor recreational facilities, including athletic fields and courts, playgrounds, picnicking areas, and lake, river, or beach access points. Availability of community-level facilities is typically commensurate to the population's needs. (Washington Tourism Alliance, 2015)

This section discusses recreational opportunities available at various locations throughout Washington. For information on visual resources, see Section 8.1.8, Visual Resources, and for information on the historical significance of locations, see Section 8.1.11, Cultural Resources.

Coastal Region

The Coastal Region is bordered to the west by the Pacific Ocean, the north by the Puget Sound, and the south by Oregon, and includes the San Juan Islands (see Figure 8.1.7-3).[113] A number of state, county, and city parks provide beach access, with locations providing amenities for beachcombing, picnicking, swimming, fishing, and other activities (Washington State Parks, 2015b).

The Olympic National Forest is known for Seal Rock Campground and its many waterfalls. Abutting the forest, the Olympic National Park includes Kalaloch Beach, Rialto Beach, Hurricane Ridge, and other frequently visited areas. Recreational activities include hiking, horseback riding, bicycling, backpacking, and other trail use; camping and picnicking; boating, swimming, SCUBA diving, and other water activities; downhill skiing and snowboarding, cross-country skiing, and other winter activities; and seasonal, licensed hunting (USFS, 2015a) (NPS, 2015a).

The San Juan Island National Historical Park contains six miles of saltwater beach, specializing in beach activities and hiking trails, and an interpretive center focusing on the island's history containing both an American Camp and an English Camp dating back to 1859 (NPS, 2015b).

Puget Sound

The Puget Sound region stretches from the Canadian border to the area surrounding the Puget Sound (see Figure 8.1.7-3). Seattle is the major population center of the region, with notable

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

attractions including the Space Needle, Smith Tower, the Washington State Ferries, and several popular art museums (Visit Seattle, 2015).

The Mt. Baker-Snoqualmie National Forest is one of the most visited forests in the country, in the Cascade Mountains, known for mountain peaks and old growth forests. The Skagit Wild and Scenic River is popular for birdwatching: the Eagle Watchers program established locations for people to watch wintering bald eagles without disturbing them. Other recreational activities include hiking, horseback riding, bicycling, and other trail use; camping and picnicking; boating, swimming, and other water activities; downhill skiing and snowboarding, snowmobiling, cross-country skiing, and other winter activities; and seasonal, licensed hunting (USFS, 2015b).

The North Cascades National Park has more than 300 glaciers, more than any other park in the contiguous United States. Known for its alpine wilderness, activities within the park focus on the peaks of the Cascade Mountains and areas developed for recreation, including the Ross Lake National Recreation Area. Activities include hiking, horseback riding, bicycling, mountain climbing, and other trail use; camping and picnicking; and boating, fishing, and other water activities (NPS, 2015c).

Mount Rainier National Park, surrounding the active volcano, is known for its five developed areas and wilderness areas. The park is popular for mountain climbing; other activities in the park include hiking, bicycling, and other trail use; camping and picnicking; boating, fishing, and other water activities; and sledding, downhill skiing and snowboarding, snowshoeing, and other winter activities (NPS, 2015d).

Cascade Mountains

The Cascade Mountains Region is bordered to the north by Canada, and stretches south across the state to Oregon (see Figure 8.1.7-3). While the mountains are the primary feature of the region, the range extends beyond the borders of the region. The region has a variety of interesting features that have become tourist destinations. The Grand Coulee Dam is known for its Visitor Center, guided tours, and summer laser light show projected onto the dam (Bureau of Reclamation, 2015a). The Yakima Valley is known for its agro tourism: wineries, craft breweries, and specialty farms are popular destinations (Yakima Valley Tourism, 2015).

The Okanogan-Wenatchee National Forest consists of the eastern Cascade Mountains, and is visited for hiking trails including the Boulder Cave Trail and the Washington Pass Observation Site. The Gifford Pinchot National Forest is visited for the Mount St. Helens National Volcanic Monument and the Mt. Adams Summit trails. Activities within the forests include hiking, horseback riding, bicycling, and other trail use; camping and picnicking; boating, swimming, and other water activities; downhill skiing and snowboarding, snowmobiling, cross-country skiing, and other winter activities; and seasonal, licensed hunting (USFS, 2015c) (USFS, 2015d).

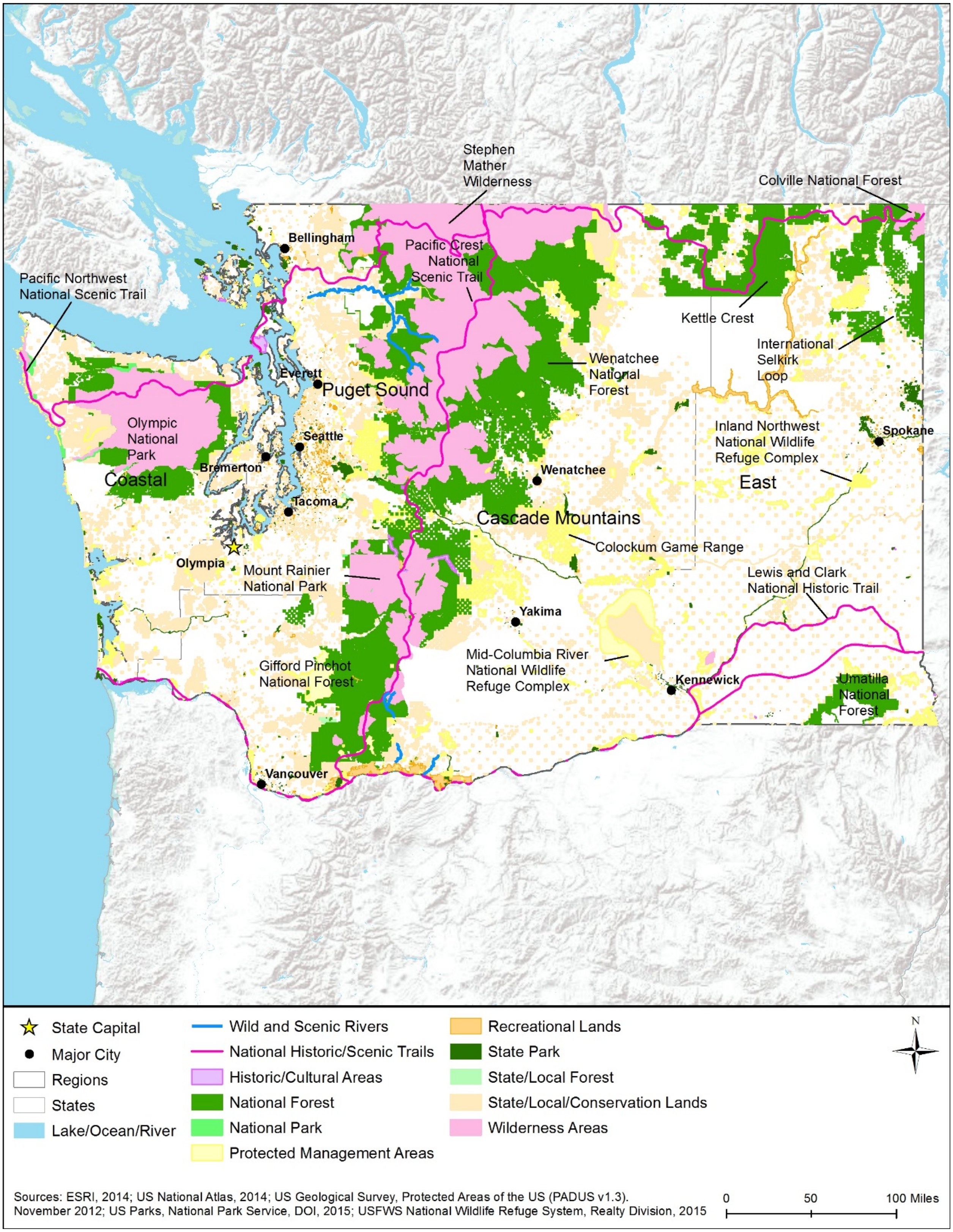


Figure 8.1.7-3: Washington Recreation Resources

East Region

The East Region lies east of the Cascade Mountains, with a dry, desert climate, and is bordered to the north by Canada, Idaho to the east, and Oregon to the south (see Figure 8.1.7-3). Spokane is the major population center of the region, popular for attractions including casinos, amusement parks, and the Spokane Falls SkyRide. Located on the Spokane River, the city is near to Riverside State Park, known for the Bowl and Pitcher rock formation and white-water rafting (Visit Spokane, 2015).

Colville National Forest, in the northern part of the East Region, contains areas including the 49° North Mountain Resort, known for backcountry skiing, and the Salmo-Priest Wilderness, popular for hiking trails leading to backcountry hiking and camping. The Umatilla National Forest, in the southern part of the region, contains the Columbia and Snake Rivers, trails leading to scenic overlooks, and the Ukiah-Granite Roadside Geology tour, a self-paced driving route. Activities within the forests include hiking, horseback riding, bicycling, geocaching, and other trail use; huckleberry picking, mushroom hunting, camping and picnicking; boating, swimming, tubing, and other water activities; downhill skiing and snowboarding, snowmobiling, cross-country skiing, and other winter activities; and seasonal, licensed hunting (USFS, 2015e) (USFS, 2015f).

The Lake Roosevelt National Recreation Area, created by the Grand Coulee Dam in the Cascade Mountains Region, is a 130-mile long lake. The area has been cultivated for water-based activities, including boating, fishing, and swimming. Multi-use trails are used for hiking, bicycling, and wildlife viewing. Other activities in the recreation area include camping, picnicking, and licensed, seasonal hunting (NPS, 2015e).

8.1.7.6. 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 8.1.7-4depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[114] service is based on the airspace classification (FAA, 2008).

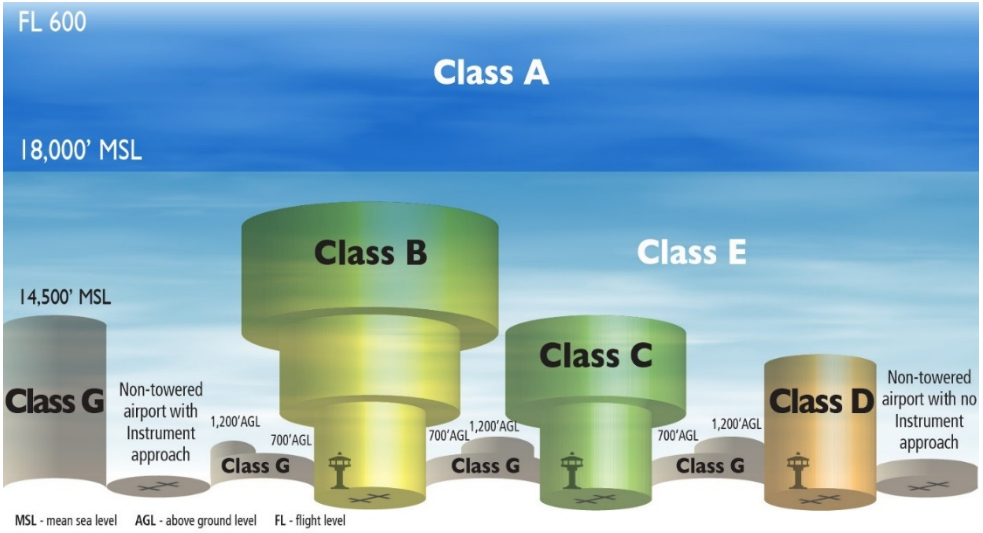


Figure 8.1.7-4: National Air Space Classification Profile

Source: Derived from (FAA, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[115]. 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).[116]
- **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.

[114] ATC – Approved authority service to provide safe, orderly, and expeditious flow of air traffic operations (FAA, 2015d).
[115] 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).
[116] IFR – Rules for the conduct of flights under instrument meteorological conditions (FAA, 2015d).

- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2008).

Uncontrolled Airspace

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

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (See Table 8.1.7-6).

Table 8.1.7-6: SUA Designations

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

SUA Type	Definition
National Security Areas (NSA)	"Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 99.7. Regulatory prohibitions are issued by System Operations, System Operations Airspace and Aeronautical Information Manual (AIM) Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

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

Other Airspace Areas

Other airspace areas, explained in Table 8.1.7-7, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 8.1.7-7: Other Airspace Designations

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

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

8.1.7.7. Aerial System Considerations

Unmanned Aerial Systems

Unmanned Aerial Systems (UASs) are widely used by the military, private entities, public service, educational institutions, federal/state/local governments, and other agencies. The FAA's Unmanned Aircraft Systems Integration Office integrates UAS into the NAS. The *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap of 2013* addresses the actions and considerations needed to integrate UAS into the NAS "without reducing existing capacity, decreasing safety, negatively impacting current operators, or increasing the risk to airspace users or persons and property on the ground any more than the integration of comparable new and novel technologies" (FAA, 2013 First Edition).

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.

8.1.7.8. Obstructions to Airspace Considerations

The Airports Division of the FAA is responsible for the evaluation and analysis of proposed construction or alterations on airports. The FAA Air Traffic Office is responsible for determining obstructions to air navigation as a result of construction off airports that may affect the safe and efficient use of navigable airspace and the operation of planned or existing air navigation and communication facilities. Such facilities include air navigation aids, communication equipment, airports, federal airways, instrument approach or departure procedures, and approved off-airway routes. An Obstruction Evaluation and Airport Airspace Analysis (OE/AAA) is required when there is the potential for airport construction/alteration of a facility that may impinge upon the NAS. Per 14 CFR Part 77.9, the FAA is to be notified about construction or alterations when:

- "Any construction or alteration exceeding 200 ft. above ground level
- Any construction or alteration:

  - within 20,000 ft. of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with its longest runway more than 3,200 ft.
  - within 10,000 ft. of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 ft.
  - within 5,000 ft. of a public use heliport which exceeds a 25:1 surface
- Any highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards
- When requested by the FAA
- Any construction or alteration located on a public use airport or heliport regardless of height or location" (FAA, 2015e).

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

8.1.7.9. Washington Airspace

The Washington Aviation Division of the WSDOT is responsible for guiding a coherent statewide strategy in aviation development and maintenance to ensure there is adequate aviation capacity for future, predicted growth. The Aviation Division provides a technical assistance program to help communities meet the requirements of the land use legislation – Growth Management Act (GMA) (RCW 36.70A.510, RCW 36.70.547). Objectives of the program are to:

- "Ensure the functions and values of airports are protected and enhanced statewide.
- Assist towns, cities, and counties in meeting update deadlines for comprehensive plans and development regulations.
- Provide education, workshops, and training on best practices to protect airports from adjacent incompatible development and enhance airport operations to meet transportation demand.
- Showcase the good work of local governments in implementing GMA requirements." (WSDOT, 2015c)

There are two FAA FSDOs for Washington located in Seattle and Spokane (FAA, 2015k).

Washington airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP addresses the strategic planning and future development for the state's airport system, as well as addressing key associated with their airports (NASAO, 2015). Figure 8.1.7-5 presents the different aviation airports/facilities residing in Washington, while Figures Figure 8.1.7-6 and Figure 8.1.7-7 presents the breakout by public and private airports/facilities. There are approximately 548 airports within Washington as presented in Table 8.1.7-8 and Figure 8.1.7-5 through Figure 8.1.7-7 (USDOT, 2015a).

Table 8.1.7-8: Type and Number of Washington Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	124	240
Heliport	0	164
Seaplane	12	4
Ultralight	1	3
Balloonport	0	0
Gliderport	0	0
Total	**137**	**411**

Source: (USDOT, 2015a)

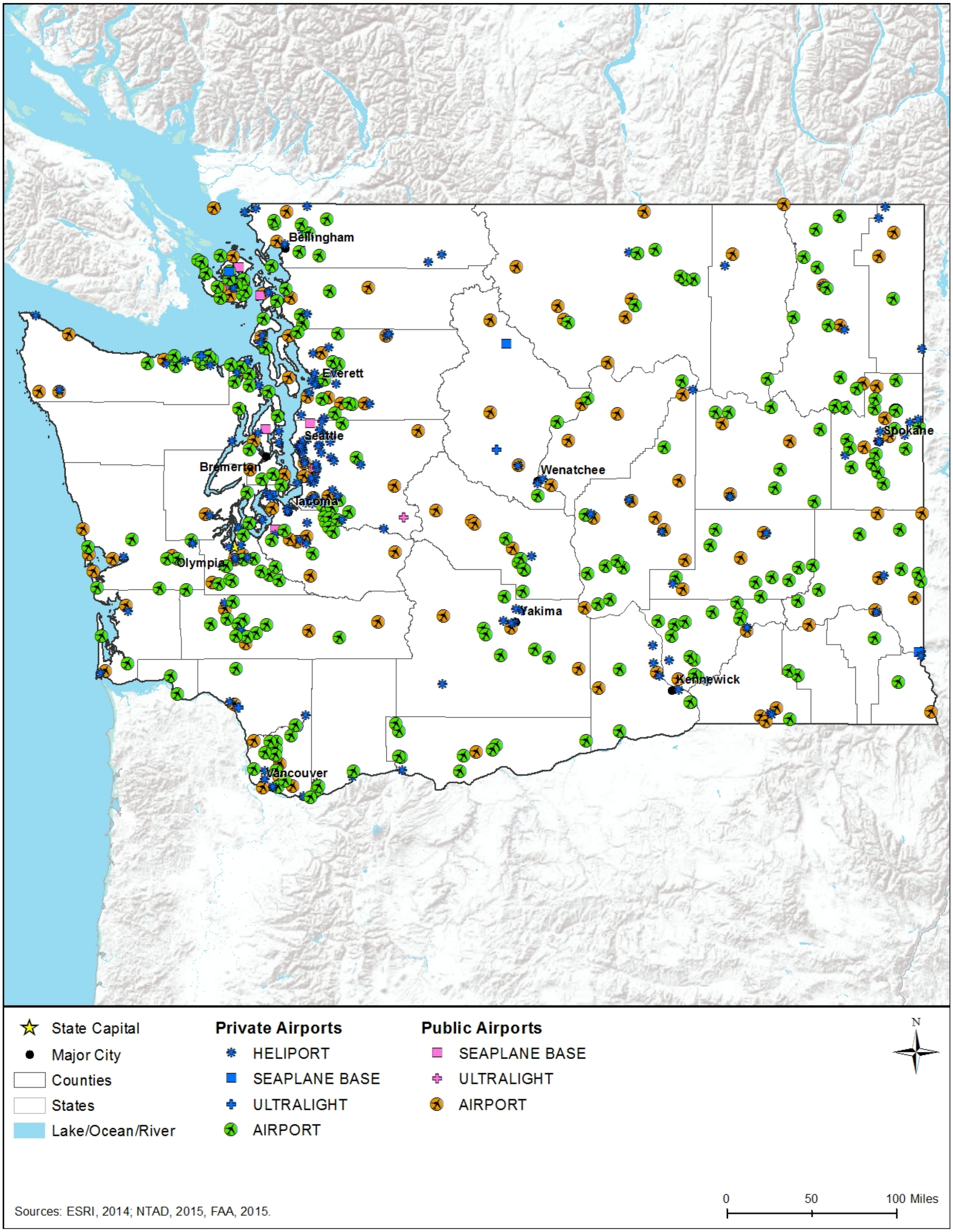


Figure 8.1.7-5: Composite of Washington Airports/Facilities

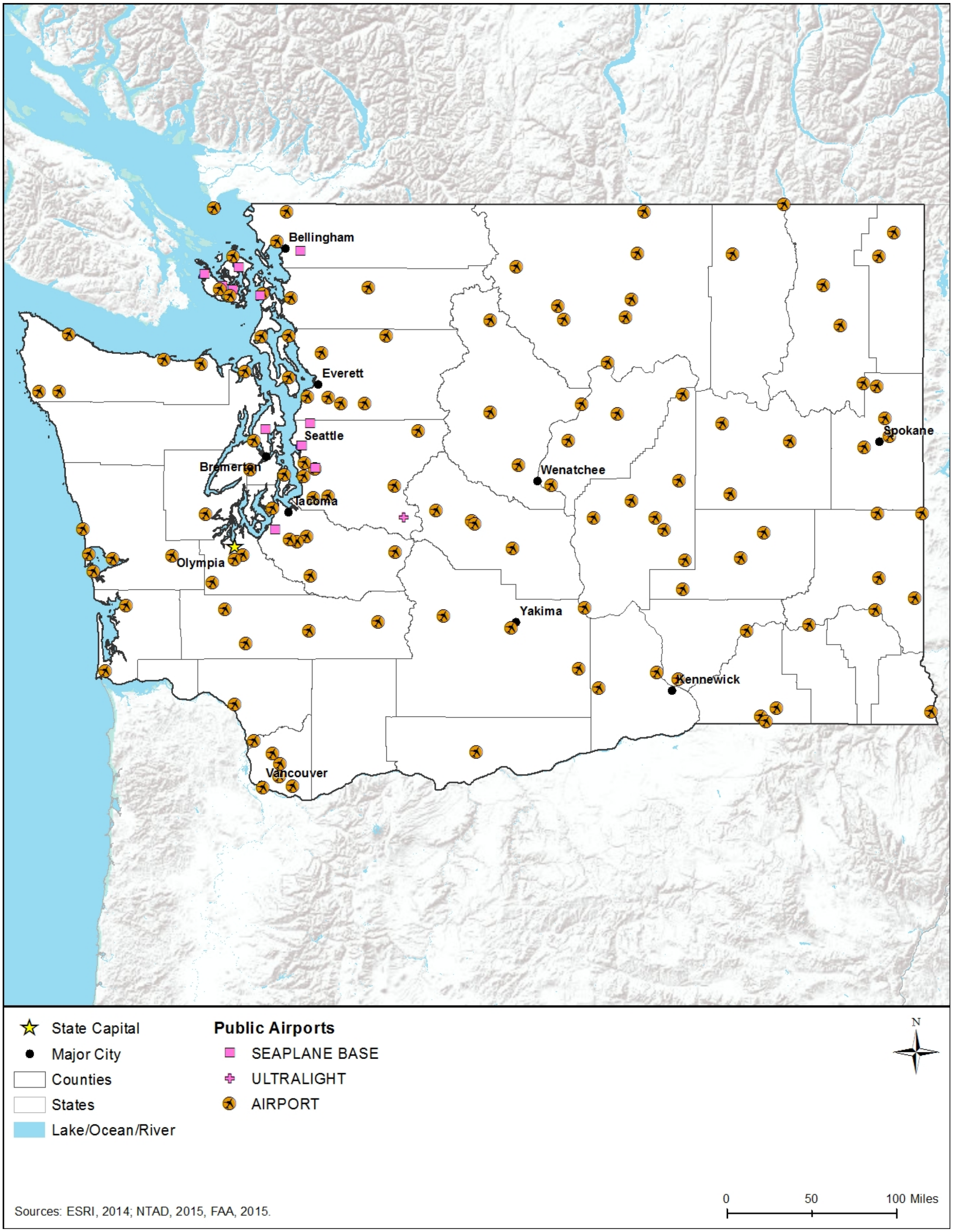


Figure 8.1.7-6: Public Washington Airports/Facilities

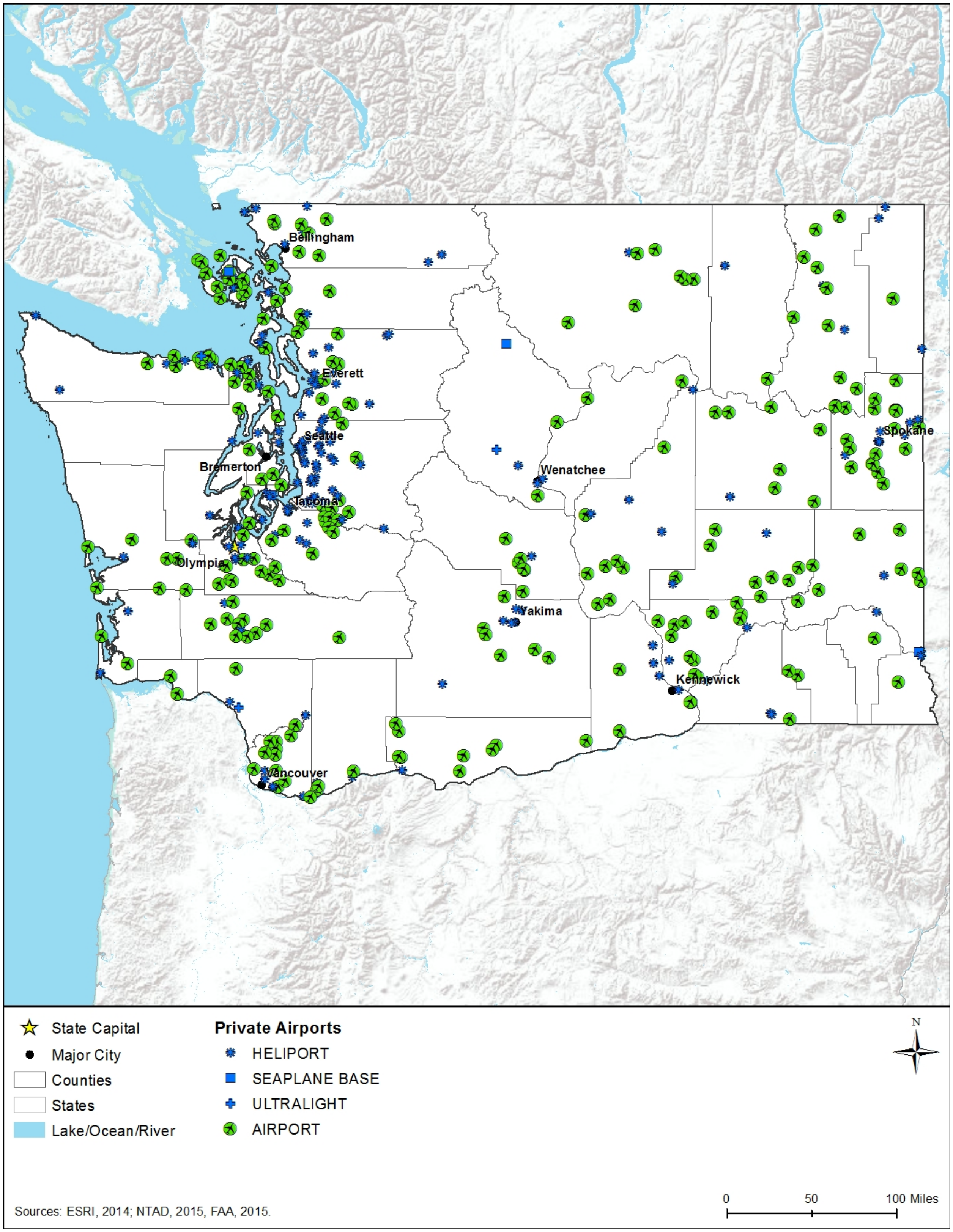


Figure 8.1.7-7: Private Washington Airports/Facilities

There are Class B, Class C, and D controlled airports as follows:

- One Class B –
  - Seattle-Tacoma International, Seattle
- Four Class C –
  - Fairchild Air Force Base (AFB), Spokane
  - Spokane International, Spokane
  - Vancouver International, British Columbia Canada (Point Roberts, Washington)
  - Whidbey Island Naval Air Station, Ault Field, Whidbey Island
- 15 Class D –
  - Abbotsford Airport, British Columbia Canada (Point Roberts, Washington)
  - Bellingham International
  - Everett, Snohomish County Airport (Paine Field), Everett
  - Fort Lewis, Gray Army Airfield, Fort Lewis
  - Moses Lake, Grant County, Moses Lake
  - Olympia Airport
  - Pasco, Tri-Cities
  - Renton Municipal
  - Boeing Field/King County International, Seattle
  - Felts Field, Spokane
  - McChord AFB, Tacoma
  - Tacoma Narrows, Tacoma
  - Pearson Field, Vancouver
  - Walla Walla Regional
  - Yakima Air Terminal
  - Seattle-Tacoma International Airport, Seattle (This Class D airspace consist of airspace extending upward from the surface and designated as an extension to a Class C surface area.) (FAA, 2015f)

SUAs (i.e., one prohibited areas, nineteen restricted areas, twelve MOAs, and one alert area) located in Washington are as follows:

- Bangor (Prohibited) –
  - P-51 – Surface to, but not including, 2,500 MSL
- Admiralty Inlet (Restricted) –
  - R-6701 – Surface to 5,000 feet MSL
- Joint Base Lewis-McChord (Restricted)

 - R-6703A – Surface to 14,000 feet MSL
 - R-6703B – Surface to 14,000 feet MSL
 - R-6703C – Surface to 14,000 feet MSL
 - R-6703D – Surface to 14,000 feet MSL
 - R-6703E – Surface to 14,000 feet MSL
 - R-6703F – Surface to 5,000 feet MSL
 - R-6703G – Surface to 5,000 feet MSL
 - R-6703H – Surface to 5,000 feet MSL
 - R-6703I – Surface to 5,000 feet MSL
 - R-6703J – Surface to 5,000 feet MSL
- Yakima (Restricted)
 - R-6714A – Surface to, but not including, 29,000 feet MSL
 - R-6714B – Surface to, but not including, 29,000 feet MSL
 - R-6714C – Surface to, but not including, 29,000 feet MSL
 - R-6714D – Surface to, but not including, 29,000 feet MSL
 - R-6714E – 29,000 feet MSL to, but not including, 55,000 feet MSL
 - R-6714F – Surface to, but not including, 29,000 feet MSL
 - R-6714G – Surface to, but not including, 29,000 feet MSL
 - R-6714H – Surface to, but not including, 5,500 feet MSL (FAA, 2015g)

The twelve MOAs for Washington are as follows:

- Chinook –
 - A – 300 feet MSL to 5,000 feet MSL
 - B – 300 feet MSL to 5,000 feet MSL
- Okanogan –
 - A – 9,000 feet MSL to, but not including, FL 180
 - B – 300 feet AGL to, but not including, 9,000 feet MSL; Excluding that airspace 1,500 feet AGL and below within a three NM radius of the following airports: Twisp Municipal Airport, Washington and the Methow Valley State Airport, Winthrop, Washington
 - C – 300 feet AGL to, but not including, 9,000 feet MSL; Excluding that airspace 1,500 feet AGL and below within a three NM radius of the Hart Ranch Airport, Tonasket, Washington
- Olympic –
 - A – From 6,000 feet MSL to, but not including, FL 180; Excluding that airspace below 1,200 feet AGL
 - B – From 6,000 feet MSL to, but not including FL 180; Excluding that airspace below

1,200 feet AGL

- Rainier –
  - 1 – 2,000 feet MSL to 9,000 feet MSL; Excluding the airspace in R-6703D and E
  - 2 – 2,000 feet MSL to 9,000 feet MSL; Excluding the airspace in R-6703 A, B, C, D, E, F, H, and J
  - 3 – 2,000 feet MSL to 9,000 feet MSL; Excluding the airspace in R-6703F, G, H and I
- Roosevelt –
  - A – 9,000 feet MSL to, but not including, FL 180
  - B – 300 feet AGL to, but not including 9,000 feet MSL; Excluding the airspace 1,500 feet AGL and below within a three NM radius of the Ferry County Airport, Republic, Washington (FAA, 2015g)

The one Alert Area is Coupeville – A680 – Surface to and including 3,000 feet MSL (FAA, 2015g). The SUAs for Washington are presented in Figure 8.1.7-8. There is one TFR (40599) located above Vancouver (See Figure 8.1.7-8) (FAA, 2015h). There are three National Security Areas as follows in Washington (See Figure 8.1.7-8):

- NSA 0003 Bremerton – Surface to 2,900 feet MSL
- NSA 0004 Everett – Surface to 1,900 feet MSL
- NSA 0005 Hanford – Surface to 1,800 feet MSL (FAA, 2015g)

The restrictions associated with this NSA may impact the airspace in the area. Figure 8.1.7-9 presents the MTRs in Washington consisting of five Visual Routes, twelve Instrument Routes, and two Slow Routes.

UAS Considerations

The NPS signed a policy memorandum on June 24, 2014 that “directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service” (NPS, 2014b). There are 15 National Parks in Washington that must comply with this agency directive (NPS, 2014e).

Obstructions to Airspace Considerations

Several references in the Washington statutes address airspace hazards. As defined in RCW Title 14 Aeronautics, Chapter 14.12 Airport Zoning, Section 14.12.010, an airport hazard is “any structure or tree or use of land which obstructs the airspace required for the flight of aircraft in landing or taking-off at an airport or is otherwise hazardous to such landing or taking-off of aircraft” (Washington State Legislature, 2015c).

Permits may be required “before constructing or establishing a new structure, or making substantial alternations or repairs to existing structures based on airport zoning regulations adopted under this chapter. A permit is required before any nonconforming structure or tree may be replaced, substantially altered or repaired, rebuilt, allowed to grow higher, or replanted. No permits will be provided where the action establishes or creates an airport hazard or when the nonconforming structure or tree or nonconforming use to be made becomes higher or becomes a greater hazard to air navigation than it was when the applicable regulation was adopted or than it is when the application for a permit is made” (Washington State Legislature, 2015d).

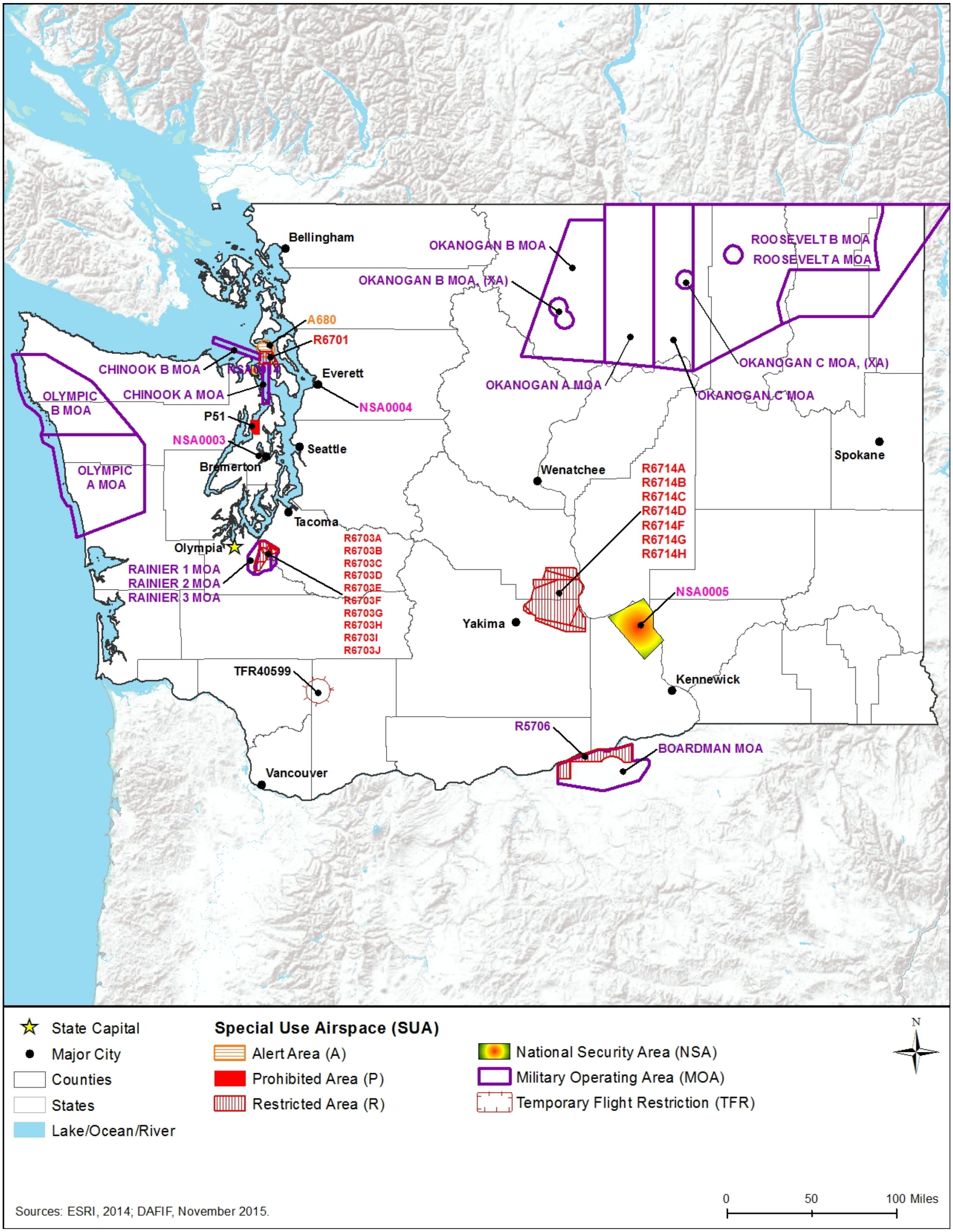


Figure 8.1.7-8: SUAs in Washington

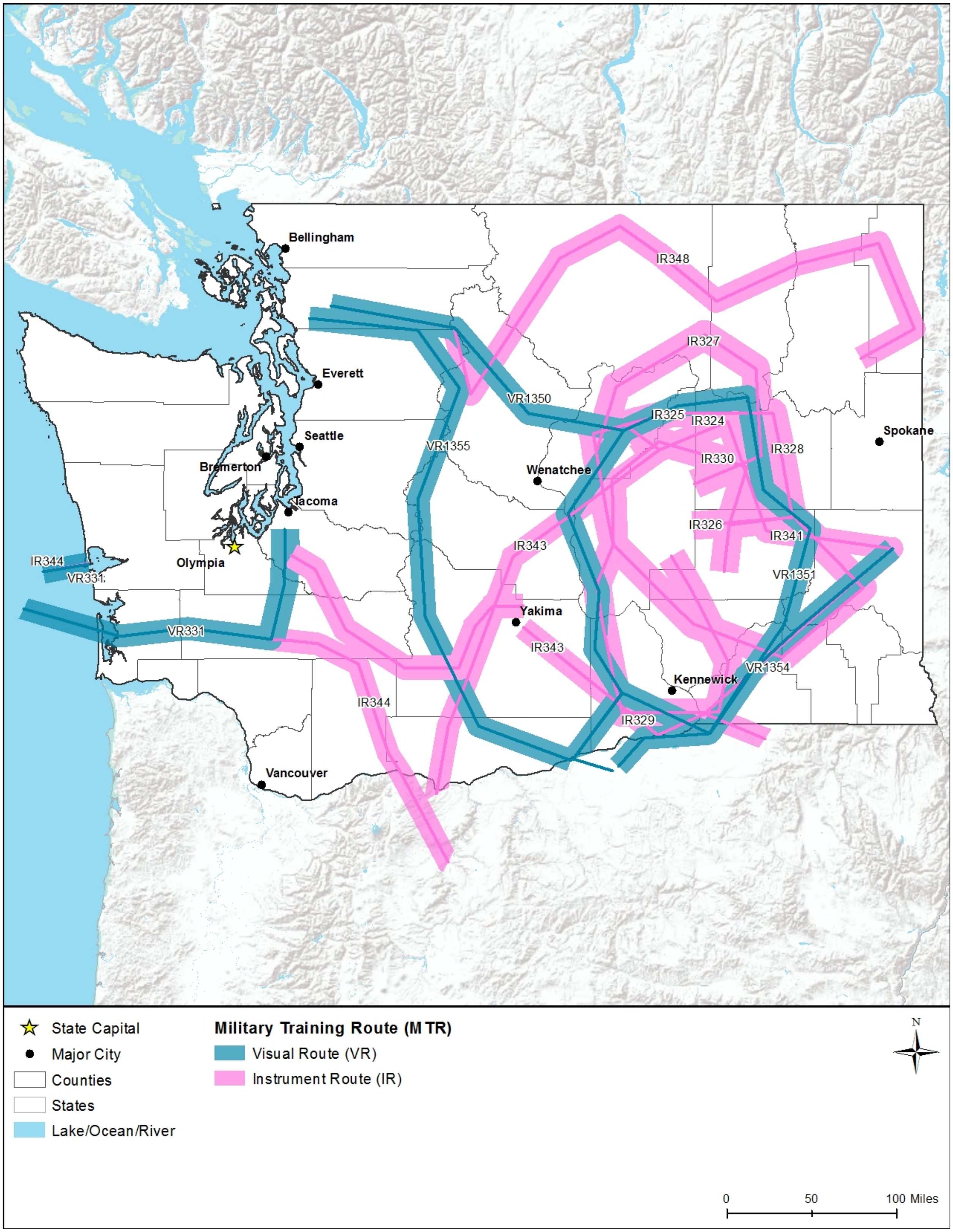


Figure 8.1.7-9: MTRs in Washington

8.1.8. Visual Resources

8.1.8.1. Definition of the Resource

Visual resources influence the human experience of a landscape. Various aspects combine to create visual resources, such as color, contrast, texture, line, and form. Features such as mountain ranges, city skylines, ocean views, unique geological formations, rivers, and constructed landmarks such as bridges, memorials, cultural resources, or statues are considered visual resources. For some, cityscapes are valued visual resources; for others, views of natural areas are valued visual resources. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for NEPA and National Historic Preservation Act (NHPA) compliance. The federal government does not have a single definition of what constitutes a visual resource; therefore, this PEIS will use the general definition of visual resources used by the BLM, "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)" (BLM, 1984).

8.1.8.2. Specific Regulatory Considerations

Table 8.1.8-1 presents state and local laws and regulations that relate to visual resources.

Table 8.1.8-1: Relevant Washington Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
RCW 79A.55, Scenic River System	Washington State Legislature	Management and permitting policy designed to preserve the "outstanding natural, scenic, historic, ecological, and recreational values" of designated state rivers.
RCW 27.34, Historic Preservation	Washington State Legislature	Establishes comprehensive planning for state historic programs and statewide policy regarding "archaeology, history, historic preservation and other historical matters."
RCW 36.89, Highways, Open Spaces, Parks, Other public facilities, Stormwater Control	Washington State Legislature	Establishes public areas for all Washington residents and outlines policies regarding highways, open spaces, other public facilities, and stormwater control.

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.

Where counties, cities, towns, or villages have planning documents that address scenery, character, or visual resources, the placement of towers or temporary transmission structures would be required to comply with the management or provide mitigation measures to meet.

8.1.8.3. Character and Visual Quality of the Existing Landscape

From the high mountains of the Cascade Range to the dense forests and coastline of the Olympic Peninsula, and the cultivated landscape of southeastern Washington, the state displays a wide range of visual resources. Over 40 percent of the state is characterized as forested, 16 percent as agricultural, and six percent as developed (Figure 8.1.7-1 in Section 8.1.7, Land Use, and Recreation). Visual resources within forested areas are generally comprised of continuous, natural looking cover with gradual transitions of line and color. They are typically characterized by the lack of disturbance or disruption of the landscape. Lakes, rivers, wetlands, and waterfront lands in Washington vary from vegetated riparian areas (areas located on the bank of a watercourse, lake, or tidewater) to oceanside villages, and wide, open lakeside vistas. The consistency, continuity, and lack of view obstructions from major constructed features characterizes the visual attributes of these areas

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 identified as a visually significant area.

Visual and aesthetic qualities of historic properties can contribute to the overall importance of a particular site. Such qualities relate to the integrity of the appearance and setting of these properties or resources. Viewsheds (the natural and manmade environment visible from one or more viewing points) can also contribute to the significance of historic properties or cultural resources. Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 8.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Washington, there are 1,524 NRHP listed sites. (NPS, 2015k)

The *Secretary of the Interior's Standards for the Treatment of Historic Properties* addresses four aspects: preservation, rehabilitation, restoration, and reconstruction, whereas *The Guidelines for the Treatment of Cultural Landscapes*, both authored by the NPS, provides guidance for applying protections to all aspects of the historic and cultural landscape, such as forests, gardens, trails, structures, ponds, and farming areas, to meet the Standards (NPS, 1995). The Standards require retention of the greatest amount of historic fabric, including the landscape's historic form, features, and details as they have evolved over time," which directly protects historic properties and the visual resources therein (NPS, 1995).

National Heritage Areas

National Heritage Areas are "places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape" (NPS, 2011). There are no National Heritage Areas in Washington. (NPS, 2016a)

World Heritage Area

Olympic National Park, located in western Washington along the coast is the only World Heritage Area in Washington. The park consists of three different regions that vary in topography and scenic diversity. These regions include the Pacific coastline, the Olympic Mountains, and the temperate rainforest. The coastal area offers pristine sites of rocky beaches while the Olympic Mountains offer views of glaciated mountains and rugged forest. The rainforest is dominated by majestic conifers including Sitka spruce, western hemlock, and Coast Douglas-fir. (United Nations Educational, Scientific, and Cultural Organization, 2015)

National Historic Landmarks

National Historic Landmarks (NHLs) are defined as “nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States” (NPS, 2015f). NHLs may include historic buildings, sites, structures, objects ,and districts (NPS, 2016b). Other types of historic properties include battlefields and canals. The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities, among other attributes, that may be considered visual resources or visually sensitive at these sites. In Washington, there are 24 NHLs, including Mount Rainier National Park, Panama Hotel, and Puget Sound Naval Shipyard (Figure 8.1.8-1) (NPS, 2014e). By comparison, there are over 2,500 NHLs in the United States, with over 10 percent of these located in Washington (NPS, 2015j). Figure 8.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive.

State Historical Sites

State Historical Sites are likely to contain scenic or aesthetic components that may be considered visual resources or visually sensitive. There are over 1,800 registered historical sites throughout the state from rural areas to urban areas (Washington State Department of Archeology & Historic Preservation, 2015d). Examples of historic sites include the Charles Cobb House (1905), the Rosario School (1891), and the University of Washington Nuclear Reactor Building (1960). For additional information regarding these properties and resources, see Section 8.1.11, Cultural Resources.

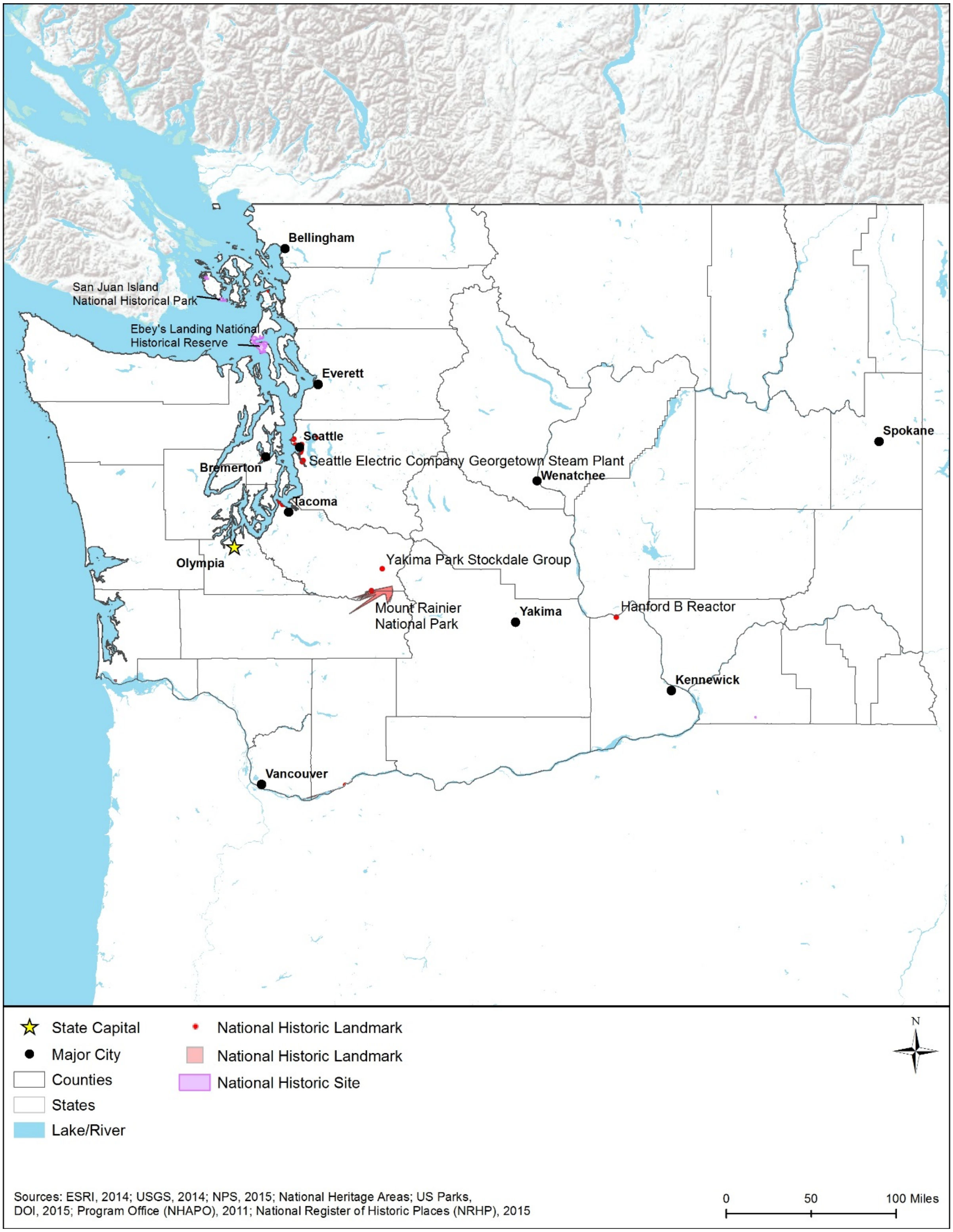


Figure 8.1.8-1: Representative Sample of Some Historic and Cultural that May be Visually Sensitive

8.1.8.4. Parks and Recreation Areas

Parks and recreation areas include state parks, National Recreation Areas, National Seashores, National Forests, and National and State Trails. Parks and recreation areas often contain scenic resources and tend to be visited partly because of their associated visual or aesthetic qualities. Figure 8.1.7-1in Section 8.1.7, Land Use, Recreation, and Airspace identifies parks and recreational resources that may be visually sensitive in Washington. For additional information about recreation areas, including national and state parks, see Section 8.1.7, Land Use, Recreation, and Airspace.

State Parks

State parks contain natural, historic, cultural, and/or recreational resources of significance to Washington residents and visitors. There are 143 state parks throughout Washington (Figure 8.1.8-3),[117] most of which contain scenic or aesthetic areas considered to be visual resources or visually sensitive (Washington State Parks, 2015a). Table 8.1.8-2 contains a sampling of state parks and their associated visual attributes.

Table 8.1.8-2: Examples of Washington State Parks and Associated Visual Attributes

State Park	Visual Attributes
Birch Bay	Bay, beach, and forest vistas
Moran (see Figure 8.1.8-2)	Views of forests, freshwater lakes, historic buildings, San Juan Islands
Rockport	Scenic views of old-growth forest, panoramic views from the top of Sauk Mountain
Wallace Falls	Wallace River and lake shoreline, 265-foot waterfall, old-growth forest

Source: (Washington State Parks, 2015a)

Figure 8.1.8-2: Moran State Park

Source: (Washington State Parks, 2016)

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

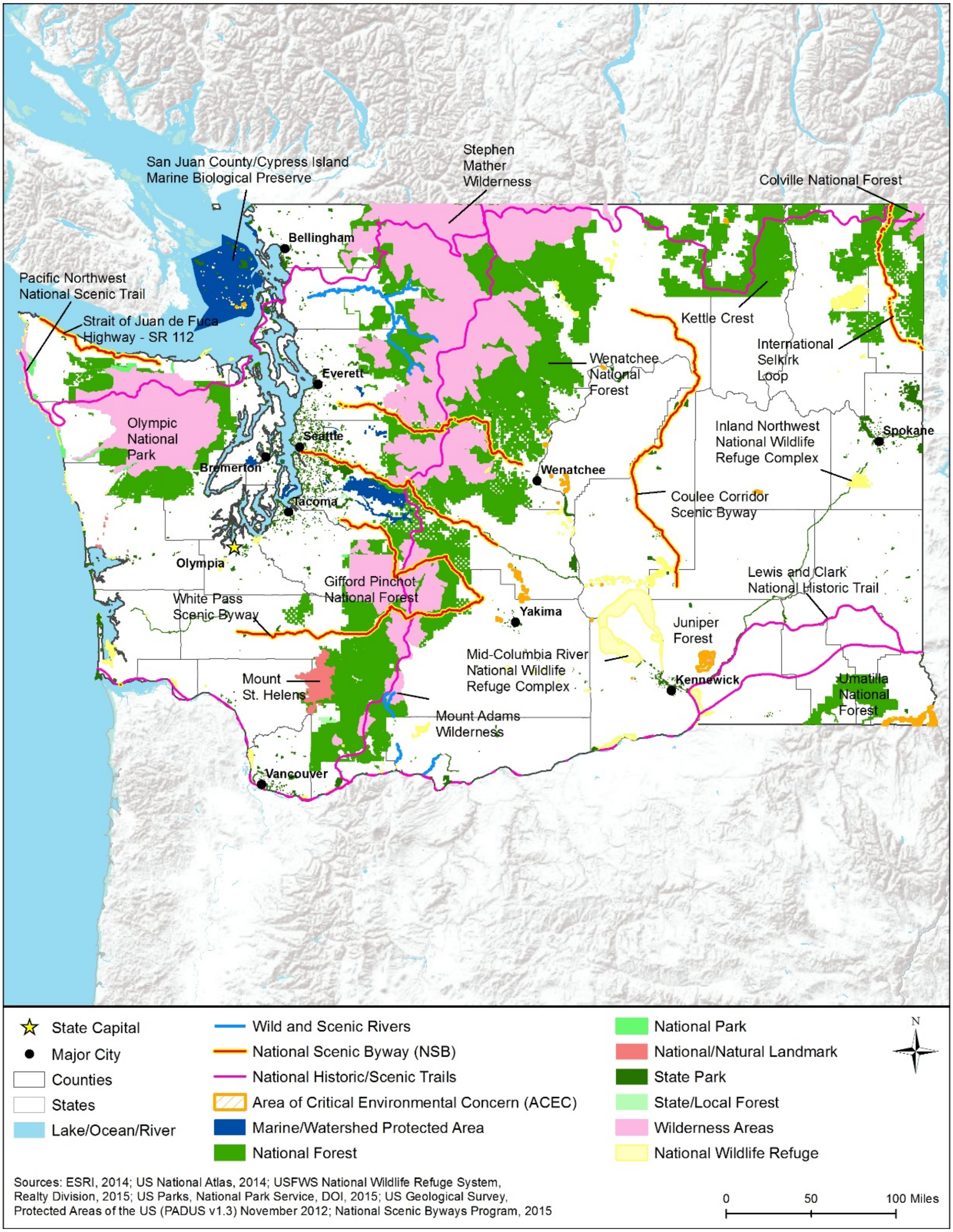


Figure 8.1.8-3: Natural Areas that May be Visually Sensitive

National Park Service

The NPS manages national parks, which contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation and are maintained for the public's use. In Washington, there are 14[118] officially designated National Parks and NPS affiliated areas, such as National Heritage Areas. There are 3 National Parks, 2 National Recreation Areas, 5 National Historical Parks, 1 National Historical Reserve, 3 National Historic Sites (Figure 8.1.8-3), 1 National Scenic Area, and 1 National Volcanic Monument. Table 8.1.8-3 identifies the National Parks and affiliated areas located in Washington. For additional information regarding parks and recreation areas, see Section 8.1.7, Land Use, Recreation, and Airspace.

Figure 8.1.8-4: Mount Rainier National Park

Source: (NPS, 2015d)

Table 8.1.8-3: Washington National Parks and Affiliated Areas

Area Name	
Ebey's Landing National Historical Reserve	Fort Vancouver National Historic Site
Klondike Gold Rush – Seattle Unit National Historical Park	Lake Chelan National Recreation Area
Lake Roosevelt National Recreation Area	Lewis and Clark National Historical Park
Manhattan Project National Historical Park	Minidoka National Historic Site
Mount Rainier National Park (see Figure 8.1.8-4)	Nez Perce National Historical Park
North Cascades National Park	Olympic National Park

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

Area Name	
San Juan Island National Historical Park	Whitman Mission National Historic Site
Columbia River Gorge National Scenic Area	Mount St. Helens National Volcanic Monument

Source: (NPS, 2014e)

National Forests

The USDA National Forests contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation. In Washington, there are six National Forests: Colville National Forest, Gifford Pinchot National Forest, Mt. Baker-Snoqualmie National Forest, Okanogan-Wenatchee National Forest, Olympic National Forest, and Umatilla National Forest (Figure 8.1.8-4).

Federal and State Trails

Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Scenic Trails (NSTs) are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass" (NPS, 2014c). There are two National Scenic Trails within Washington: the Pacific Northwest NST and the Pacific Crest NST, both administered by the NPS. Administered by the NPS, the Lewis and Clark Trail, a National Historic Trail that passes through a total of 11 states, also passes through Washington (NPS, 2014c) (NPS, 2016c).

The National Trails System Act authorized the designation of National Recreational Trails near urban areas (American Trails 2015). There are over 1,100 National Recreation Trails across the nation administered by the U.S. Forest Service, U.S. Army Corps of Engineers, USFWS, local or state governments, and non-profit organizations (National Recreation Trails, 2015).

8.1.8.5. Natural Areas

National Wilderness Areas

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

Washington is home to 31 federally managed Wilderness Areas located throughout the state (Figure 8.1.8-3) (NPS, 2015g).

Natural Area Preserves

Washington natural area preserves are comprised of 56 sites covering more than 38,290 acres throughout the state. These areas "protect the best remaining examples of many ecological communities including rare plant and animal habitat." (Washington State Department of Natural Resources, 2015h). Noted for their preservation of natural and scenic resources, these areas may be visually sensitive.

Rivers Designated as National or State Wild, Scenic or Recreational

National Wild, Scenic, or Recreational Rivers are those rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-1287). These rivers have outstanding natural, cultural, and recreational values, including potential visual resources. Portions of six rivers (197 miles) have been designated as National Wild and Scenic Rivers in Washington:

- Illabot Creek,
- Klickitat River,
- Pratt River,
- Skagit River,
- Snoqualmie (Middle Fork) River, and
- White Salmon River (National Wild and Scenic Rivers System, 2015a).

Figure 8.1.8-5: Skagit River Wild and Scenic River

Source: (National Wild and Scenic Rivers System, 2015b)

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, 2015aj). There are

23 NWRs in Washington (Table 8.1.8-4). Visual resources within the NWRs include views and sites of the coast, beaches, wildlife, and naturally vegetated areas.

Table 8.1.8-4: Washington National Wildlife Refuges

NWR Name	
Columbia National Wildlife Refuge	Nisqually National Wildlife Refuge
Conboy Lake National Wildlife Refuge	Pierce National Wildlife Refuge
Copalis National Wildlife Refuge	Protection Island National Wildlife Refuge
Dungeness National Wildlife Refuge	Quillayute Needles National Wildlife Refuge
Flattery Rocks National Wildlife Refuge	Ridgefield National Wildlife Refuge
Franz Lake National Wildlife Refuge	Saddle Mountain National Wildlife Refuge
Grays Harbor National Wildlife Refuge	San Juan Islands National Wildlife Refuge
Julia Butler Hansen Refuge for the Columbian White-Tailed Deer	Steigerwald Lake National Wildlife Refuge
Lewis and Clark National Wildlife Refuge	Toppenish National Wildlife Refuge
Little Pend Oreille National Wildlife Refuge	Turnbull National Wildlife Refuge
McNary National Wildlife Refuge	Umatilla National Wildlife Refuge
	Willapa National Wildlife Refuge

Source: (USFWS, 2015aj)

State Wildlife Management Areas (WMAs) are lands owned by Washington and managed by the Washington Department of Fish and Wildlife. There are 33 WMAs covering over one million acres scattered throughout the state (Washington State Department of Fish and Wildlife, 2015). For additional information on wildlife refuges and management areas, see Section 8.1.6.4., Wildlife.

National Natural Landmarks

NNLs are sites designated by the U.S. Secretary of the Interior that “contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education” (NPS, 2014d). These landmarks may be considered visual resources or visually sensitive. In Washington, 18 NNLs exist entirely or partially within the state (Table 8.1.8-5). Some of the natural features located within these areas include “an outstanding exhibit of sea action in sculpturing a rocky shoreline, lava flows containing an unusually large number of fossil tree species, and the largest, most spectacular and most significant of several large water gaps through basalt anticlines.” (NPS, 2012a). Another example, Point of Arches NNL, contains scenic rocky tidelands and upland vegetation (Figure 8.1.8-6).

Figure 8.1.8-6: Point of Arches NNL

Source: (NPS, 2012b)

Table 8.1.8-5: Washington National Natural Landmarks

NNL Name	
Boulder Park and McNeil Canyon Haystack Rocks	Davis Canyon
Drumheller Channels	Gingko Petrified Forest
Grand Coulee	Grande Ronde Feeder Dikes
Grande Ronde Goosenecks	Kahlotus Ridgetop
Mima Mounds	Nisqually Delta
Point of Arches	Rose Creek Preserve
Sis Corner Eskers and Kame Complex	Steptoe and Kamiak Buttes
The Great Gravel Bar of Moses Coulee	Umtanum Ridge Water Gap
Wallula Gap	Withrow Moraine and Jameson Lake Drumlin Field

Source: (NPS, 2012a)

8.1.8.6. Additional Areas

National and State Scenic Byways

National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. Washington has seven designated National Scenic Byways:

- Chinook Scenic Byway
- Coulee Corridor Scenic Byway
- International Selkirk Loop
- Mountains to Sound Greenway I-90
- Stevens Pass Greenway
- Strait of Juan de Fuca Highway – SR 112
- White Pass Scenic Byway

The U.S. DOT, Federal Highway Administration, manages the National Scenic Byways Program. Similar to National Scenic Byways, Washington Scenic Byways are transportation corridors that are of particular statewide interest. There are 16 State Scenic Byways (Figure 8.1.7-1 in Section 8.1.7 Land Use, Recreation, and Airspace).

8.1.9. Socioeconomics

8.1.9.1. Definition of the Resource

NEPA requires consideration of socioeconomics in NEPA analysis; specifically, Section 102(A) of NEPA requires federal agencies to "insure the integrated use of the natural and social sciences…in planning and in decision making" (42 U.S.C. § 4332(A)). Socioeconomics refers to a broad, social science-based approach to understanding a region's social and economic conditions. It typically includes population, demographic descriptors, economic activity indicators, housing characteristics, property values, and public revenues and expenditures (BLM, 2005). When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of FirstNet Proposed Actions, and in addition, FirstNet Proposed Actions may affect the socioeconomic conditions of a region.

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet's mission is to provide public safety broadband and interoperable emergency communications coverage throughout the nation. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes. The financial arrangements for deployment and operation of the FirstNet network may have socioeconomic implications. This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

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. This PEIS addresses environmental justice in a separate section (Section 8.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: Land Use, Recreation, and Airspace (Section 8.1.7), Infrastructure (Section 8.1.1), and Visual Resources (Section 8.1.8).

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau[119] (Census Bureau) and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this PEIS. In all cases, this section uses the most recent data available for each geography at the time of writing. At the county, state, region, and United States levels, the data are typically for 2013 or 2014. For smaller geographic areas, this section uses data from the Census Bureau's American Community Survey (ACS). The ACS is the Census Bureau's flagship demographic estimates program for years other than the decennial census years. This PEIS uses the 2009-2013 ACS, which is based on surveys (population samples) taken across that five-year period; thus, it is not appropriate to attribute its data values to a specific year. It is a valuable source because it provides the most accurate and consistent socioeconomic data across the nation at the sub-county level (U.S. Census Bureau, 2016).

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

8.1.9.2. Specific Regulatory Considerations

Research for this section did not identify any specific state, local, or tribal laws or regulations that are directly relevant to environmental justice for this PEIS. However, multiple departments of the state have developed policies, programs, and guidance regarding environmental justice.

The Washington State Board of Health (WSBH) in 2001 created a set of guidelines to encourage state and local government agencies to promote and consider environment justice in government decisions and actions. WSBH encouraged state and local agencies to incorporate these

[119] For U.S. Census Bureau sources, a URL (see references section) that begins with "http://factfinder.census.gov" indicates that the American FactFinder (AFF) interactive tool can be used to retrieve the original source data via the following procedure. If the reference's URL begins with "http://dataferrett.census.gov," significant socioeconomic expertise is required to navigate this interactive tool to the specific data. However, the data can usually be found using AFF. As of May 24, 2016, the AFF procedure is as follows: 1) Go to http://factfinder.census.gov. 2) Select "Advanced Search," then "Show Me All." 3) Select from "Topics" choices, select "Dataset," then select the dataset indicated in the reference; e.g. "American Community Survey, 2013 1-Year Estimates" or "2012 Census of Governments." Click "Close." Note: ACS is the abbreviation in the AFF for the American Community Survey. SF is the abbreviation used with the 2000 and 2010 "Summary Files." For references to the "2009-2013 5-Year Summary File," choose "2013 ACS 5-year estimates" in the AFF. 4) Click the "Geographies" box. Under "Select a geographic type," choose the appropriate type; e.g. "United States – 010" or "State – 040" or "..... County – 050" then select the desired area or areas of interest. Click "Add to Your Selections," then "Close." For Population Concentration data, select "Urban Area - 400" as the geographic type, then select 2010 under "Select a version" and then choose the desired area or areas. Alternatively, do not choose a version, and select "All Urban Areas within United States." Regional values cannot be viewed in the AFF because the regions for this PEIS do not match Census Bureau regions. All regional values were developed by downloading state data and using the most mathematically appropriate calculations (e.g., sums of state values, weighted averages, etc.) for the specific data. 5) In "Refine your search results," type the table number indicated in the reference; e.g. "DP04" or "LGF001." The dialogue box should auto-populate with the name of the table(s) to allow the user to select the table number/name. Click "Go." 6) In the resulting window, click the desired table under "Table, File, or Document Title" to view the results. If multiple geographies were selected, it is often easiest to view the data by clicking the "Download" button above the on-screen data table. Choose the desired comma-delimited format or presentation-ready format (includes a Microsoft Excel option). In some cases, the structure of the resulting file may be easier to work with under one format or another. Note that in most cases, the on-screen or downloaded data contains additional parameters besides those used in the FirstNet PEIS report table. Readers must locate the FirstNet PEIS-specific data within the Census Bureau tables. Additionally, the data contained in the FirstNet tables may incorporate data from multiple sources and may not be readily available in one table on the Census site.

guidelines into their respective policies and procedures. (Washington State Board of Health, 2001) (Washington State Board of Health, 2015)

Washington DOE includes environmental justice as a key component of its diversity policy. The policy was developed in 2005 and applies to Ecology's workforce and its programmatic, policy, and other interactions with state residents. (Washington Department of Ecology, 2013b) Washington DOE has an environmental justice Coordinator and Committee responsible for addressing statewide issues as they relate to the agency's mission, and integrating environmental justice in Ecology's programs. Washington DOE developed an Environmental Justice Checklist to guide Washington DOE staff through the process of considering environmental justice as part of their projects and activities. The checklist helps staff assess how agency's actions might affect communities, and consider whether minority groups may need special accommodations (e.g., translation services) to foster effective discussions. (University of California, Hastings College of Law, 2010) (Washington Department of Ecology, 2013c)

WSDOT, in its Environmental Manual, Chapter 458, Social and Community Effects, provides a framework for consideration of environmental justice in evaluating WSDOT transportation improvement projects (WSDOT, 2015d). WSDOT's environmental justice web page provides various guidance documents for environmental justice assessments (WSDOT, 2016).

8.1.9.3. Communities and Populations

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

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

Statewide Population and Population Growth

Table 8.1.9-1 presents the 2014 population and population density of Washington in comparison to the West region[120] and the nation. The estimated population of Washington in 2014 was 7,061,530. The population density was 106 persons per square mile (sq. mi.), which was higher than the population density of the region (98 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Washington was the 13th largest state by population among the 50 states and the District of Columbia, 20th largest by land area, and had the 26th greatest population density (U.S. Census Bureau, 2015e; U.S. Census Bureau, 2015f).

Table 8.1.9-1: Land Area, Population, and Population Density of Washington

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Washington	66,455.52	7,061,530	106

[120] The West region is comprised of Arizona, California, Idaho, Nevada, Oregon, and Washington. Throughout the socioeconomics section, figures for the West region represent the sum of the values for all states in the region, or an average for the region based on summing the component parameters. For instance, the population density of the West region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
West Region	624,241	61,039,316	98
United States	3,531,905	318,857,056	90

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

Population growth is an important subject for this PEIS given FirstNet's mission. Table 8.1.9-2 presents the population growth trends of Washington from 2000 to 2014 in comparison to the West region and the nation. The state's annual growth rate decreased slightly from 1.33 percent to 1.23 percent in the 2010 to 2014 period compared to 2000 to 2010. The growth rate of Washington in the 2010 to 2014 period was higher than the growth rate of the region (1.08 percent) and substantially higher than the nation's (0.81 percent).

Table 8.1.9-2: Recent Population Growth of Washington

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
Washington	5,894,121	6,724,540	7,061,530	830,419	336,990	1.33%	1.23%
West Region	51,610,010	58,469,720	61,039,316	6,859,710	2,569,596	1.26%	1.08%
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, 2015g; U.S. Census Bureau, 2015e)
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 U.S. Census Bureau does not prepare population projections for the states. Therefore, Table 8.1.9-3 presents projections of the 2030 population from two sources that are national in scope and use different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data and analysis service (ProximityOne, 2015) (University of Virginia Weldon Cooper Center, 2015). The table provides figures for numerical change, percentage change, and annual growth rate based on averaging the projections from the two sources. The average projection indicates Washington's population will increase by approximately 1.2 million people, or 17.6 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 1.02 percent, which is lower than the historical growth rate from 2010 to 2014. The projected growth rate of the state nearly matches that of the region (1.03 percent) and is considerably higher than the projected growth rate of the nation (0.80 percent).

Table 8.1.9-3: Projected Population Growth of Washington

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
Washington	7,061,530	8,393,113	8,210,522	8,301,818	1,240,288	17.6%	1.02%
West Region	61,039,316	73,661,854	70,107,981	71,884,918	10,845,602	17.8%	1.03%
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, 2015e; UVA Weldon Cooper Center, 2015) (ProximityOne, 2015)
AARC = Average Annual Rate of Change (compound growth rate)

Population Distribution and Communities

Figure 8.1.9-1 presents the distribution and relative density of the population of Washington. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density – therefore, areas that are solid in color are particularly high in population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 2015h).

This map also presents the 10 largest population concentrations in the state, outlined in purple. These population concentrations reflect contiguous, densely developed areas as defined by the Census Bureau based on the 2010 census (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015d). These population concentrations often include multiple incorporated areas as well as some unincorporated areas.

Other groupings of brown dots on the map represent additional, but smaller, population concentrations. Dispersed dots indicate dispersed population across the less densely settled areas of the state. The very sparsely populated area in the coastal region west of Bremerton is the Olympic Mountains region. The sparsely populated area between the Seattle and Wenatchee/Yakima and running north to Cuanada and south to Oregon is the Cascade mountain range. Sparsely populated areas in the eastern portion of the state are other mountainous areas and high desert areas. For more information about these regions, see Section 8.1.7, Land Use, Recreation, and Airspace.

Table 8.1.9-4 provides the populations of the 10 largest population concentrations in Washington, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[121] In 2010, the largest population concentration by far was the Seattle area, which had approximately 3 million people. The state had no other population

[121] U.S. 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, U.S. Census Bureau classification of a subarea as no longer qualifying as a concentrated population due to population losses, and reclassification by the U.S. 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.

concentrations over a million. The second largest population concentration was the Spokane area with 387,847 people. The smallest of these 10 population concentrations was the Wenatchee area, with a 2010 population of 67,227. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Kennewick/Pasco area, with an annual growth rate of 3.21 percent.

Table 8.1.9-4 also shows that the top 10 population concentrations in Washington accounted for 72.1 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 81.3 percent of the entire state's growth.

Table 8.1.9-4: Population of the 10 Largest Population Concentrations in Washington

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Bellingham	84,324	114,473	114,668	9	30,149	3.10%
Bremerton	178,369	198,979	199,093	5	20,610	1.10%
Kennewick/Pasco	153,851	210,975	216,228	4	57,124	3.21%
Marysville	114,372	145,140	147,396	7	30,768	2.41%
Olympia/Lacey	143,826	176,617	179,586	6	32,791	2.08%
Portland (OR/WA) (WA Portion)	284,441	359,562	367,517	3	75,121	2.37%
Seattle	2,712,205	3,059,393	3,123,594	1	347,188	1.21%
Spokane	334,858	387,847	391,324	2	52,989	1.48%
Wenatchee	55,425	67,227	66,865	10	11,802	1.95%
Yakima	112,816	129,534	130,600	8	16,718	1.39%
Total for Top 10 Population Concentrations	4,174,487	4,849,747	4,936,871	NA	675,260	1.51%
Washington (statewide)	5,894,121	6,724,540	6,819,579	NA	830,419	1.33%
Top 10 Total as Percentage of State	70.8%	72.1%	72.4%	NA	81.3%	NA

Sources: (U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j) (U.S. Census Bureau, 2012)
AARC = Average Annual Rate of Change (compound growth rate)

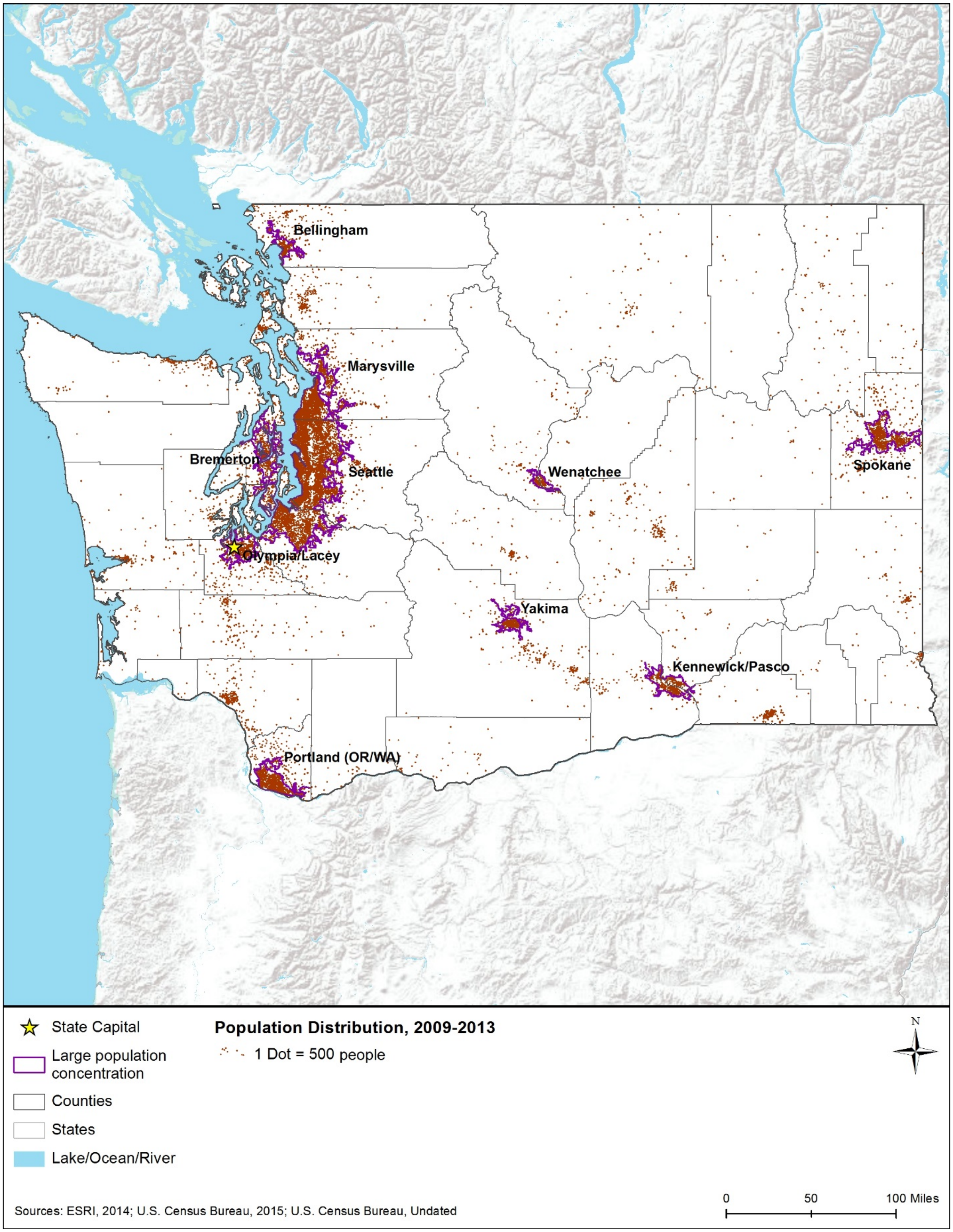


Figure 8.1.9-1: Population Distribution in Washington, 2009–2013

8.1.9.4. 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 Proposed Actions are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 8.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 8.1.9-5 compares several economic indicators for Washington to the West region and the nation. The table presents two indicators of income[122] – 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 8.1.9-5, the per capita income in Washington in 2013 ($30,672) was $2,014 higher than that of the region ($28,658), and $2,488 higher than that of the nation ($28,184) (BLS, 2015b; U.S. Census Bureau, 2015k; U.S. Census Bureau, 2015l; U.S. Census Bureau, 2015m).

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 8.1.9-5 shows that in 2013, the MHI in Washington ($58,431) was $1,360 higher than that of the region ($57,071), and $6,181 higher than that of the nation ($52,250) (BLS, 2015b; U.S. Census Bureau, 2015k; U.S. Census Bureau, 2015l; U.S. Census Bureau, 2015m).

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

[122] The U.S. Census Bureau defines income as follows: "'Total income' is the sum of the amounts reported separately for wage or salary income; net self-employment income; interest, dividends, or net rental or royalty income or income from estates and trusts; Social Security or Railroad Retirement income; Supplemental Security Income (SSI); public assistance or welfare payments; retirement, survivor, or disability pensions; and all other income. Receipts from the following sources are not included as income: capital gains, money received from the sale of property (unless the recipient was engaged in the business of selling such property); the value of income "in kind" from food stamps, public housing subsidies, medical care, employer contributions for individuals, etc.; withdrawal of bank deposits; money borrowed; tax refunds; exchange of money between relatives living in the same household; gifts and lump-sum inheritances, insurance payments, and other types of lump-sum receipts." (U.S. Census Bureau, 2015n)

unemployment rate as the number of unemployed individuals who are looking for work divided by the total number of individuals in the labor force. Table 8.1.9-5 compares the unemployment rate in Washington to the West region and the nation. In 2014, Washington's statewide unemployment rate of 6.2 percent was lower than the rate for the region (7.2 percent) and matched the nation's rate[123] (BLS, 2015b; U.S. Census Bureau, 2015k; U.S. Census Bureau, 2015l; U.S. Census Bureau, 2015m).

Table 8.1.9-5: Selected Economic Indicators for Washington

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Washington	$30,672	$58,431	6.2%
West Region	$28,658	$57,071	7.2%
United States	$28,184	$52,250	6.2%

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

Figure 8.1.9-2 and Figure 8.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015k) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 8.1.9-1 (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015d). Following these two maps, Table 8.1.9-6 presents MHI and unemployment for the 10 largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to those on the maps. Nonetheless, both the maps and the table help portray differences in income and unemployment across Washington.

Figure 8.1.9-2 shows that, in general, counties with 2013 MHI above the national median were located in the western portions of the state, around the largest population concentrations, with a few exceptions. Most of the remainder of the state had MHI levels below the national average. The counties classified as having the lowest MHI levels were distributed throughout the state. Table 8.1.9-6 shows that the 2009–2013 MHI in the 10 largest population concentrations ranged from $42,463 (Yakima area) to $67,176 (Seattle area); the state average was $59,478.

Figure 8.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that the great majority of counties had unemployment rates above the national average. Only a small number of counties around the Seattle area, and a few other exceptions, had unemployment rates below the national average (that is, better employment performance). When comparing unemployment in the population concentrations to the state average, Table 8.1.9-6 shows that the 2009–2013 unemployment rates in the 10 largest population concentrations ranged from 7.6 percent (Kennewick/Pasco area) to 11.5 percent (Portland area, Washington portion); the state average was 9.4 percent.

[123] The timeframe for the unemployment rates can change quarterly.

Detailed employment data provide useful insights into the nature of a local, state, or national economy. Table 8.1.9-7 provides figures on employment percentages by type of worker and by industry based on surveys conducted in 2013 by the Census Bureau. By class of worker (type of worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers in Washington was similar to that of the West region and slightly lower than that of the nation. The percentage of government workers was higher in the state than in the region and nation. The percentage of self-employed workers in Washington was lower than in the region and similar to that in the nation.

By industry, Washington has a mixed economic base and some notable figures in the table are as follows. Washington in 2013 had a higher percentage of persons working in "manufacturing" than did the region. The state had a lower percentage of persons in and "educational services, and health care and social assistance" than the nation. It also had a lower percentage of persons working in the "arts, entertainment, and recreation, and accommodation and food services" when compared to the region. The rest of the percentage values for Washington were within one percentage point of the region and nation.

Table 8.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Washington, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Bellingham	$47,101	10.1%
Bremerton	$60,049	9.6%
Kennewick/Pasco	$58,400	7.6%
Marysville	$67,078	9.8%
Olympia/Lacey	$62,039	9.3%
Portland (OR/WA) (WA Portion)	$55,858	11.5%
Seattle	$67,176	8.6%
Spokane	$47,462	10.0%
Wenatchee	$51,995	8.5%
Yakima	$42,463	11.1%
Washington (statewide)	$59,478	9.4%

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

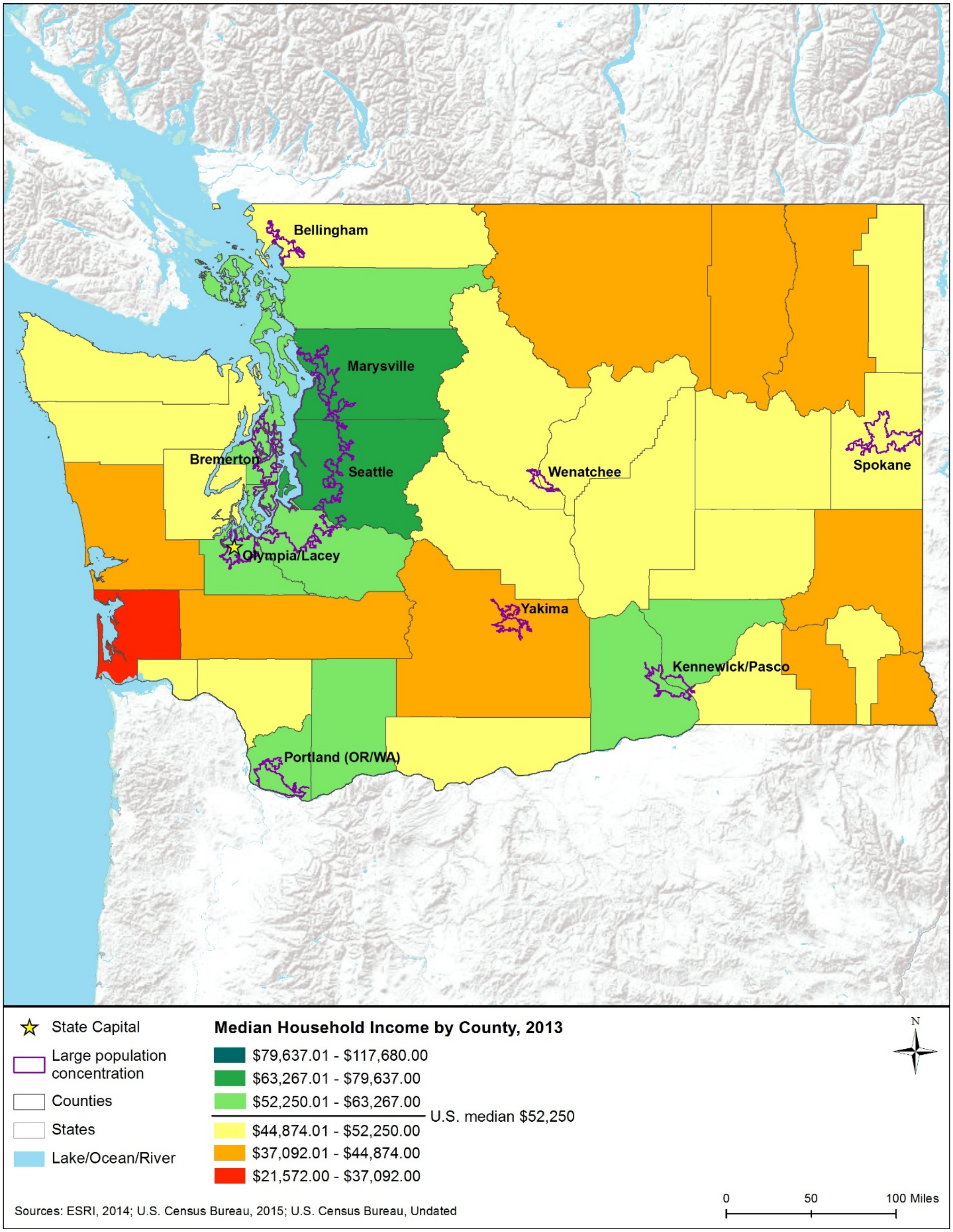


Figure 8.1.9-2: Median Household Income in Washington, by County, 2013

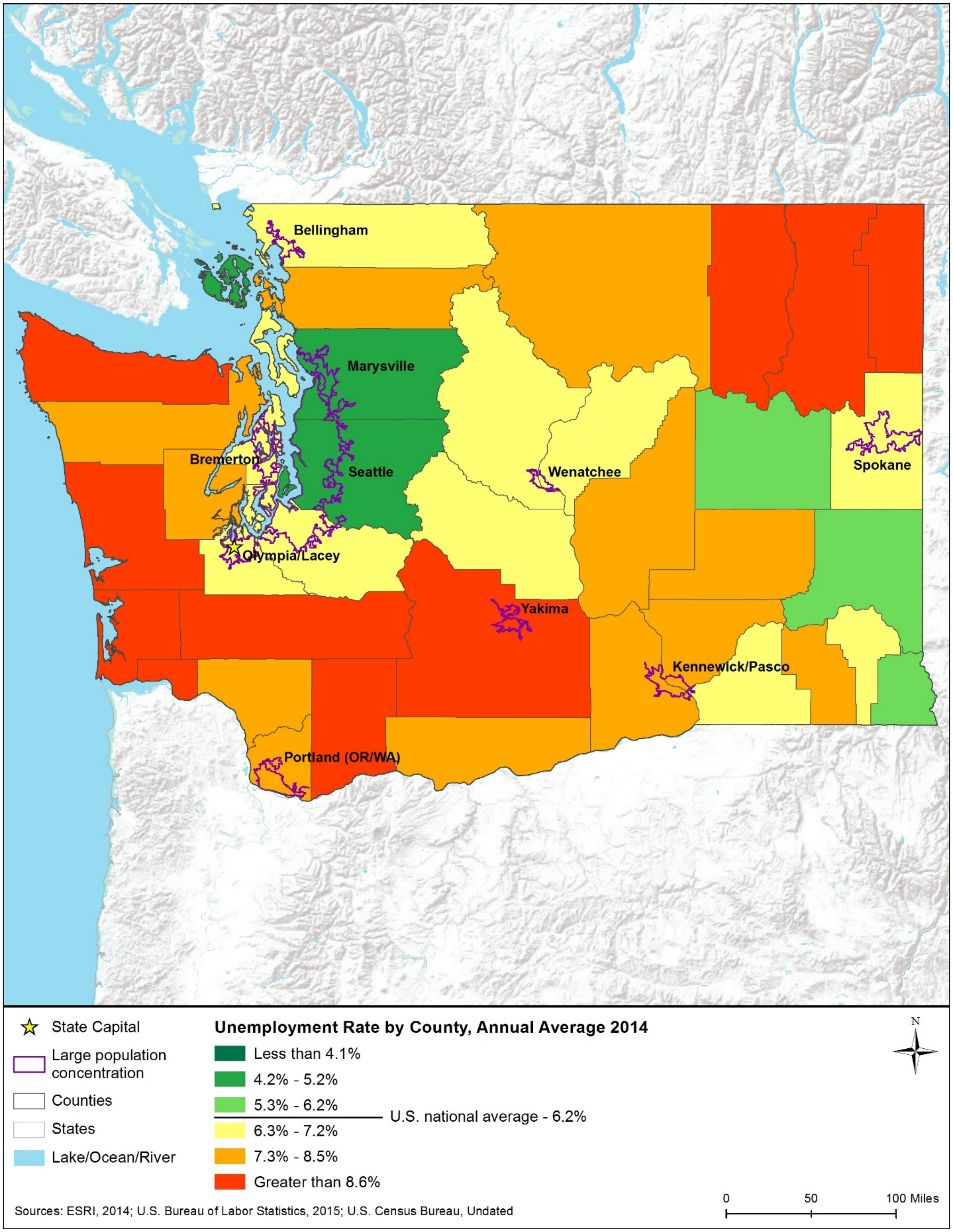


Figure 8.1.9-3: Unemployment Rates in Washington, by County, 2014

Table 8.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Washington	West Region	United States
Civilian Employed Population 16 Years and Over	3,229,431	26,912,315	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	78.0%	78.4%	79.7%
Government workers	15.9%	13.9%	14.1%
Self-employed in own not incorporated business workers	5.9%	7.5%	6.0%
Unpaid family workers	0.2%	0.2%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	2.6%	2.5%	2.0%
Construction	5.9%	6.1%	6.2%
Manufacturing	10.7%	9.5%	10.5%
Wholesale trade	3.0%	2.9%	2.7%
Retail trade	12.0%	11.6%	11.6%
Transportation and warehousing, and utilities	5.0%	4.7%	4.9%
Information	2.4%	2.6%	2.1%
Finance and insurance, and real estate and rental and leasing	5.6%	6.3%	6.6%
Professional, scientific, management, administrative, and waste management services	12.1%	12.3%	11.1%
Educational services, and health care and social assistance	21.5%	20.9%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	9.4%	10.9%	9.7%
Other services, except public administration	4.8%	5.2%	5.0%
Public administration	5.1%	4.6%	4.7%

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

Table 8.1.9-8 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 8.1.9-7 for 2013.

Table 8.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in Washington, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Bellingham	4.7%	3.2%	1.5%	10.4%
Bremerton	6.2%	3.2%	2.1%	12.1%
Kennewick/Pasco	8.7%	6.1%	1.3%	14.8%
Marysville	8.6%	4.5%	2.4%	7.7%
Olympia/Lacey	5.6%	3.8%	1.4%	8.9%

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Portland (OR/WA) (WA Portion)	6.2%	7.2%	2.0%	10.7%
Seattle	5.4%	4.9%	3.0%	15.0%
Spokane	5.2%	5.1%	2.0%	9.9%
Wenatchee	7.4%	6.6%	1.9%	7.0%
Yakima	5.7%	5.5%	1.1%	6.9%
Washington (statewide)	6.2%	5.1%	2.3%	12.1%

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 8.1.9-9 compares Washington to the West region and nation on several common housing indicators.

As shown in Table 8.1.9-9, in 2013, Washington had a higher percentage of housing units that were occupied (90.3 percent) than the region (89.9 percent) or nation (87.6 percent). Of the occupied units, Washington had a higher percentage of owner-occupied units (61.9 percent) than the region (56.8 percent) and a lower percentage than the nation (63.5 percent). The percentage of detached single-unit housing (also known as single-family homes) in Washington in 2013 (62.9 percent) was higher than the region (60.3 percent) and the nation (61.5 percent). The homeowner vacancy rate in Washington (1.7 percent) was slightly higher than the rate for the region (1.6 percent) and slightly lower than that for the nation (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015n). The vacancy rate among rental units in Washington (4.7 percent) was lower than in the region (5.1 percent) and in the nation (6.5 percent).

Table 8.1.9-9: Selected Housing Indicators for Washington, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Washington	2,928,300	90.3%	61.9%	1.7%	4.7%	62.9%
West Region	23,159,156	89.9%	56.8%	1.6%	5.1%	60.3%
United States	132,808,137	87.5%	63.5%	1.9%	6.5%	61.5%

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

Table 8.1.9-10 provides housing indicators for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does present variation in these indicators for population concentrations across the state and compared to the state average for the 2009 to 2013 period.

Table 8.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Washington, 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
Bellingham	50,266	92.3%	53.1%	1.0%	3.8%	55.1%
Bremerton	85,354	90.9%	63.2%	2.3%	7.1%	66.1%
Kennewick/Pasco	79,657	94.2%	66.7%	1.3%	6.2%	63.9%
Marysville	56,292	93.8%	71.1%	1.4%	4.1%	74.6%
Olympia/Lacey	78,280	92.9%	61.6%	1.9%	6.0%	64.9%
Portland (OR/WA) (WA Portion)	144,705	94.5%	61.4%	1.9%	4.6%	64.0%
Seattle	1,316,072	93.6%	58.6%	1.8%	4.8%	57.1%
Spokane	169,443	92.7%	61.1%	2.1%	6.3%	65.6%
Wenatchee	26,943	91.9%	66.5%	2.3%	6.5%	63.7%
Yakima	49,513	94.0%	59.2%	2.2%	4.5%	62.5%
Washington (statewide)	2,899,538	90.7%	63.2%	2.0%	5.3%	63.4%

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

Property Values

Property values have important relationships to both the wealth and affordability of communities. Table 8.1.9-11 provides indicators of residential property values for Washington and compares these values to values for the West region and nation. The figures on median value of owner-occupied units are from the Census Bureau's ACS, based on owner estimates of how much their property (housing unit and land) would sell for if it were for sale (U.S. Census Bureau, 2015n).

The table shows that the median value of owner-occupied units in Washington in 2013 ($250,800) was lower than the corresponding values for the West region ($301,787) and higher than the value for the nation ($173,900).

Table 8.1.9-11: Residential Property Values in Washington, 2013

Geography	Median Value of Owner-Occupied Units
Washington	$250,800
West Region	$301,787
United States	$173,900

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

Table 8.1.9-12 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 median property value for these 10 communities ranged from $160,300 in the Yakima area to $326,300 in the Seattle area; the state median value was $262,100. The lowest and highest property values were in the same areas – Yakima and Seattle – that had the lowest and highest (respectively) median household incomes (Table 8.1.9-6).

Table 8.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Washington, 2009–2013

Area	Median Value of Owner-Occupied Units
Bellingham	$281,100
Bremerton	$259,800
Kennewick/Pasco	$170,900
Marysville	$249,500
Olympia/Lacey	$244,100
Portland (OR/WA) (WA Portion)	$219,100
Seattle	$326,300
Spokane	$177,000
Wenatchee	$215,900
Yakima	$160,300
Washington (statewide)	$262,100

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

Government Revenues

State and local governments obtain revenues from many sources. FirstNet Proposed Actions 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[124] 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 8.1.9-13 presents total and selected state and local government revenue sources as reported by the U.S. Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures were particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure. General and selective sales taxes may change, reflecting expenditures during system development and maintenance.

Table 8.1.9-13 shows that the state government in Washington received slightly less total revenue in 2012 on a per capita basis than its counterpart governments in the region and nation. Local governments in Washington received slightly less total revenue in 2012 on a per capita basis than their counterpart governments in the region and more than their counterparts in the nation. The state government in Washington had lower levels per capita of intergovernmental revenues[125] from the federal government, and local governments had higher levels, than their counterpart governments in the region and nation. The state government in Washington reported more revenue from property taxes on a per capita basis, while Washington's local governments reported less, than their counterparts in the region and nation. General sales taxes on a per capita basis were higher for state and local governments in Washington than for their counterparts in the region and nation. Selective sales taxes, and public utility taxes specifically, on a per capita basis were higher for state and local governments in Washington than for their counterpart governments in the region and nation. The state and local governments in Washington reported no revenue from individual or corporate income taxes.

[124] Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006).
[125] Intergovernmental revenues are those revenues received by one level of government from another level of government, such as shared taxes, grants, or loans and advances (U.S. Census Bureau, 2006).

Table 8.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		Washington		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$40,665	$39,083	$371,456	$354,200	$1,907,027	$1,615,194
	Per capita	$5,896	$5,667	$6,217	$5,928	$6,075	$5,145
Intergovernmental from Federal	($M)	$9,743	$1,863	$87,391	$15,822	$514,139	$70,360
	Per capita	$1,413	$270	$1,463	$265	$1,638	$224
Intergovernmental from State	($M)	$0	$10,249	$0	$117,358	$0	$469,147
	Per capita	$0	$1,486	$0	$1,964	$0	$1,495
Intergovernmental from Local	($M)	$268	$0	$4,161	$0	$19,518	$0
	Per capita	$39	$0	$70	$0	$62	$0
Property Taxes	($M)	$1,897	$7,327	$4,982	$71,927	$13,111	$432,989
	Per capita	$275	$1,062	$83	$1,204	$42	$1,379
General Sales Taxes	($M)	$10,614	$2,467	$52,737	$14,896	$245,446	$69,350
	Per capita	$1,539	$358	$883	$249	$782	$221
Selective Sales Taxes	($M)	$3,557	$1,229	$19,137	$7,418	$133,098	$28,553
	Per capita	$516	$178	$320	$124	$424	$91
Public Utilities Taxes	($M)	$460	$615	$1,368	$4,323	$14,564	$14,105
	Per capita	$67	$89	$23	$72	$46	$45
Individual Income Taxes	($M)	$0	$0	$65,157	$0	$280,693	$26,642
	Per capita	$0	$0	$1,091	$0	$894	$85
Corporate Income Taxes	($M)	$0	$0	$9,219	$52	$41,821	$7,210
	Per capita	$0	$0	$154	$1	$133	$23

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

Note: This table does not include all sources of government revenue. Summation of the specific source rows does not equal total revenue.

8.1.10. Environmental Justice

8.1.10.1. Definition of the Resource

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO (see Section 8.8.11).[126] The fundamental principle of environmental justice is, "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (USEPA, 2015d). 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,

[126] See https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice.

policies, and activities on minority populations and low-income populations" (Executive Office of the President, 1994). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (U.S. Department of Commerce, 2013).

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

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

- Minority populations consist of "Individual(s) who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic."
- Low-income populations consist of individuals living in poverty, as defined by the U.S. Census Bureau (Census Bureau).
- Environmental effects include social and economic effects. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment" (CEQ, 1997).

8.1.10.2. Specific Regulatory Considerations

Research for this section did not identify any specific state, local, or tribal laws or regulations that are directly relevant to environmental justice for this PEIS. However, multiple departments of the state have developed policies, programs, and guidance regarding environmental justice.

The WSBH in 2001 created a set of guidelines to encourage state and local government agencies to promote and consider environment justice in government decisions and actions. WSBH encouraged state and local agencies to incorporate these guidelines into their respective policies and procedures (Washington State Board of Health, 2001) (Washington State Board of Health, 2015).

The Washington DOE includes environmental justice as a key component of its diversity policy. Developed in 2005, the policy applies to Washington DOE's workforce and its programmatic, policy, and other interactions with state residents. (Washington Department of Ecology, 2013b) Washington DOE has an environmental justice coordinator and committee responsible for addressing statewide issues as they relate to the agency's mission, and integrating environmental justice in agency programs. Washington DOE developed an Environmental Justice Checklist to guide staff through the process of considering environmental justice as part of their projects and activities. The checklist helps staff assess how agency's actions might affect communities, and consider whether minority groups may need special accommodations (e.g., translation services) to foster effective discussions (University of California, Hastings College of Law, 2010) (Washington Department of Ecology, 2013c).

The WSDOT, in its Environmental Manual, Chapter 458, Social and Community Effects, provides a framework for consideration of environmental justice in evaluating its transportation improvement projects (WSDOT, 2015d). WSDOT's environmental justice web page provides various guidance documents for environmental justice assessments (WSDOT, 2016).

The WSBH defined "environmental justice" as "the 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 (Washington State Board of Health, 2015)." WSBH created a set of guidelines for government agencies to promote and consider environment justice in government decisions and actions. WSBH encourages state and local agencies to incorporate these guidelines into their respective policies and procedures (Washington State Board of Health, 2001).

8.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 8.1.10-1 presents 2013 data on the composition of Washington's population by race and by Hispanic origin. The state's population has lower percentages of individuals who identify as Black/African American (3.7 percent) and Some Other Race (3.7 percent) than the populations of the region and the nation. (Those percentages are, for Black/African American, 5.2 percent for the West region and 12.6 percent for the nation; and for Some Other Race, 10.0 percent, and 4.7 percent respectively.) The state's population has a lower percentage of individuals who identify as Asian (7.7 percent) than the population of the West region (10.5 percent) and a higher percentage than the population of the nation (5.1 percent). The state's population of persons identifying as White (78.0 percent) is higher than that of the West region (68.3 percent) or the nation (73.7 percent). The percentage of the population in Washington that identifies as Hispanic (11.9 percent) is considerably smaller than in the West region (31.5 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. Washington's All Minorities population percentage (29.1 percent) is considerably lower than that of the West region (51.2 percent) and the nation (37.6 percent).

Table 8.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for Washington (14.1 percent) is lower than that for the West region (16.6 percent) and nation (15.8 percent).

Table 8.1.10-1: 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		
Washington	6,971,406	78.0%	3.7%	1.4%	7.7%	0.6%	3.7%	4.9%	11.9%	29.1%
West Region	60,262,888	68.3%	5.2%	1.3%	10.5%	0.4%	10.0%	4.3%	31.5%	51.2%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

Source: (U.S. Census Bureau, 2015t)
"All Minorities" is defined as all persons who consider themselves Hispanic or of any race other than White.

Table 8.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Washington	14.1%
West Region	16.6%
United States	15.8%

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

8.1.10.4. 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 8.1.10-1 visually portrays the results of the environmental justice population screening analysis for Washington. The analysis used block group data from the U.S. Census Bureau's American Community Survey 2009-2013 Five-Year Estimates (U.S. Census Bureau, 2015h; U.S. Census Bureau, 2015v; U.S. Census Bureau, 2015w; U.S. Census Bureau, 2015x) and U.S. Census Bureau urban classification data (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015d).

Figure 8.1.10-1 shows that a high proportion of Washington has 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.

It is important to understand how the data behind Figure 8.1.10-1 affect the visual impact of this map. Block groups have similar populations (hundreds to a few thousand individuals) regardless of population density. In sparsely populated areas, a single block group may cover tens or even hundreds of square miles, while in densely populated areas, block groups each cover much less than a single square mile. Thus, while large portions of the state outside the areas defined as large population concentrations show Moderate or high potential for environmental justice populations, these low density areas reflect modest numbers of minority or low-income individuals compared to the potential environmental justice populations within densely populated areas. The overall effect of this relative density phenomenon is that the map visually shows large areas of the state having environmental justice potential, but this over-represents the presence of environmental justice populations.

It is also very important to note that Figure 8.1.10-1 does not definitively identify environmental justice populations. It indicates *degrees of likelihood of the presence* of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. Block group data may under- or over-represent the presence of these localized communities. For instance, in the large block groups in sparsely populated regions of the state, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the moderate potential category draws a wide net for potential environmental justice populations. As discussed in Appendix D, the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. Before FirstNet deploys projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Such analyses could tier off the methodology of this PEIS.This map also does not indicate whether FirstNet Proposed Actions would have actual impacts on environmental justice populations. An environmental justice effect on minority or low-income populations only occurs if the effect is harmful, significant (according to significance criteria), and “appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group” (CEQ, 1997).The Environmental Consequences section (Section 8.2) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

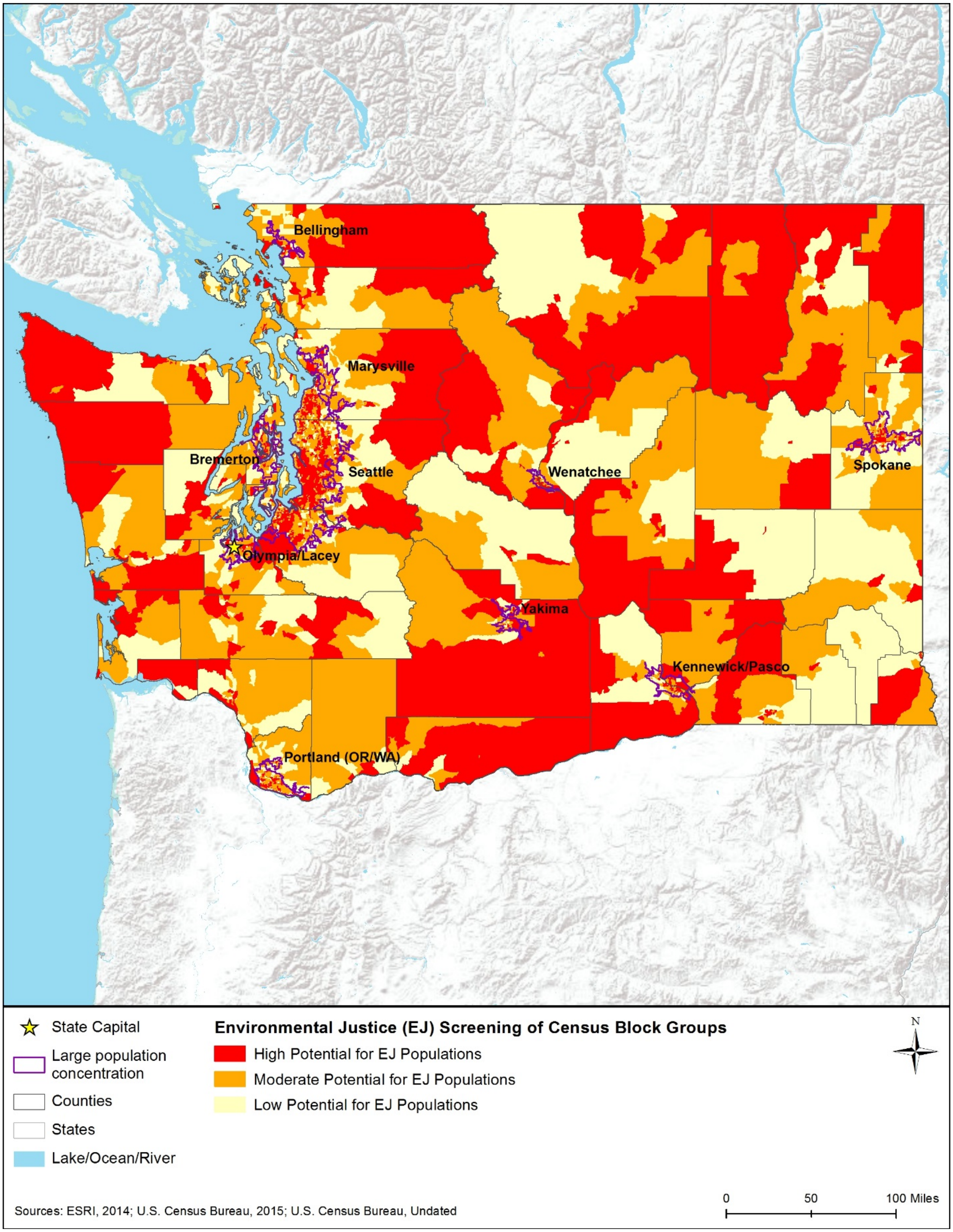


Figure 8.1.10-1: Potential for Environmental Justice Populations in Washington, 2009-2013

8.1.11. Cultural Resources

8.1.11.1. Definition of Resource

For the purposes of this PEIS, cultural resources are defined as:

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

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

- Statutory language and implementing regulations for Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), 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 program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources (NPS, 2015h); and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to American Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

8.1.11.2. 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 Cultural Resources include the NHPA (detailed in Section 1.8, Overview of Relevant Laws and Executive Orders), the American Indian Religious Freedom Act (AIRFA), ARPA, and NAGPRA. Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders" next to the text referring to Appendix C summarizes these pertinent federal laws.

Washington does not have state laws and related regulations that are similar to the NHPA or NEPA. 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 8.1.11-1 presents state and local laws and regulations that relate to cultural resources.

Table 8.1.11-1: Relevant Washington Cultural Resources Laws and Regulations

State Law/ Regulation	Regulatory Agency	Requirements
Washington Revised Code 27.34.200	Washington State Historic Preservation Office (SHPO)	Establishes the two state historical societies as trustees of the state for historic preservation and empowers them to establish a comprehensive and consistent statewide policy pertaining to archaeology, history, historic preservation, and other historical matters; Statewide coordination of historical programs; and a coordinated budget for all state historical agencies.

8.1.11.3. Cultural Setting

Through the examination of cultural materials, archaeologists have determined that human beings have occupied the U.S. Pacific Northwest, including what is now Washington, for at least 12,000 years, beginning in the Pleistocene epoch (SFU Museum of Archaeology and Ethnology, 2005). Early inhabitants are thought to have been descendants of people who crossed the Bering Land Bridge during the Wisconsin Glacial Episode (110,000 to 12,000 years ago) when the sea level was much lower than it is presently (NPS, 2016d).

Early Washington inhabitants are believed to have traveled south along the Pacific coast, relying on the abundant marine and riparian resources, as well as migrating mammoth, bison, and other large ancestral fauna (Washington State Department of Archeology & Historic Preservation, 2015e). Washington contains thousands of archaeological sites, with 54 listed on the National Register of Historic Places (NRHP) (NPS, 2015h).

The following sections examine Washington's prehistory (approximately 12000 B.C. to the historic period) and some particular elements of the historic period. Even after contact and colonization, many American Indian tribes sustained their traditional way of life in the state and some continue to do so today. Section 8.1.11.4 presents an overview of the initial human habitation in Washington and the cultural development that occurred before European contact. Section 8.1.11.5 discusses the federally recognized American Indian tribes with a cultural affiliation to the state. Section 8.1.11.6 provides a current list of significant archaeological sites in Washington and tools that the state has developed to ensure their preservation. Section 8.1.11.7 documents the historic context of the state since European contact, and Section 8.1.11.8 summarizes the architectural context of the state during the historic period.

Washingtonian people of the late-Pleistocene are understood to have comprised nomadic bands exploiting seasonal resources, including large game of the coastal region, mountains, and Plateau. As the Pleistocene concluded, giving way to more temperate climatic conditions, shifts in the resources, and prehistoric lifeways of the area were marked by an advancement in prehistoric technologies and economies. The warmer climate supported greater plant and animal diversity in the region. Larger game species, including the mammoth, giant ground sloth, and American camel (all now extinct), became absent as warming trends caused a shift to a more arid climate that altered vegetative food sources, in addition to human hunting. In response to this environmental shift, humans began to favor small game hunting over that of big game. This is traceable in the archaeological record as the manufacture of large atlatl and spear points, such as Clovis points were replaced with small projectile points suited for bow hunting of smaller, faster game. The archaeological record also shows that the exploitation of flora and fish became more common as well.

Washington is at the convergence of several physiographic regions and provinces, including the Rocky Mountain System, Pacific Mountain System, and Internontane Plateau regions, which contain the Cascade-Sierra Mountains, Columbia Plateau, Northern Rocky Mountains, and Pacific Border provinces (refer to Figure 8.1.3-1). As a result, the native residents of Washington adapted to live in varying terrain, ranging from the wet environments of the western coast of the state to the arid eastern portion of the state (Washington State Department of Natural Resources, 2016). The indigenous cultural groups identified within Washington include 29 federally recognized tribes and represent traditions shaped by ecological settings and cultural influences from Alaska to central Mexico and from the coast to the U.S. Great Plains (National Congress of American Indians, 2016) (Governor's Office of Indian Affairs, 2016).

8.1.11.4. Prehistoric Setting

According to Washington's Department of Archaeology and Historic Preservation (DAHP), the archaeological record of the native people of Washington shows "that a wide variety of game animals were used for food or hunted for materials such as pelts, horn, or teeth. Many plants were used for food or medicinal purposes. Such a diverse and varied diet implies that the early inhabitants maintained a highly flexible lifestyle capable of adapting to the changing conditions to climate and environment." (Department of Archaeology and Historic Preservation, 2003) Linguistic and cultural diversities were most pronounced to the west of the Cascade Mountains with the Makah, Quileute, Quinault, Chehalis, Chinook, Cathlamet, Athapaskan, Cowlitz, Clallam and Twana language groups, as well as others, being represented. To the east of the Cascade Mountains, American Indian language groups include, but are not limited to, the Lushootseed, Sahaptin, Nooksak, and Columbian (Hugo, 2010).

Shell midden (refuse) sites in the Northwest are concentrated on the shores of the ocean and saltwater inlets and provide a glimpse into the coastal native diet. Trade routes between coastal and inland populations have been established in the archaeological records of Washington. Notably, the Marmes Rockshelter site in the central Washington desert contained marine shell from the Pacific Ocean, a distance of at least 200 miles, demonstrating that long-distance trade between American Indian groups in Washington dates back to at least 5000 B.C. The diversity of language, technology, and lifeways are understood through the varying ecologies that different groups exploited, modified, and settled in (Department of Archaeology and Historic Preservation, 2003) (Washington State University, 2016a).

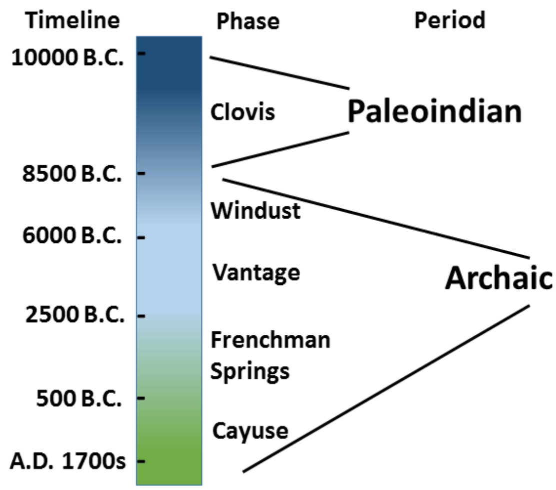


Figure 8.1.11-1: Timeline of Prehistoric Human Occupation

Sources: (Washington State University Museum of Anthropology, 2016) (NPS, 2016e)

Paleoindian Period (10000 – 8500 B.C.)

The Paleoindian Period for Washingtonian natives has been documented in the archaeological record by a small number of studies. Large game hunting and limited flora exploitation mark less than 2,000 years during the end of the Pleistocene period. Examples of early documented sites in Washington include the Lind Coulee Site in central Washington; the “Kennewick Man” burial site in Kennewick, which is over 9,000 years old; and, the “Manis Mastodon” site in Sequim. The Lind Coulee and “Manis Mastodon” sites show evidence of large-game hunting technologies and lifeways focused on exploiting a smaller range of resources as compared with later periods. Found along the bank of the Columbia River, the human remains known as “Kennewick Man” represent one of the oldest and most complete documented ancient burial sites discovered in North America (Bureau of Reclamation, 2015b) (Burke Museum, 2015).

It is not clear, according to the archaeological record, if Clovis and other large projectile point technology influenced Archaic Period technology, or vanished at the end of the Paleoindian Period. “Clovis points were made for three or four centuries, and then disappeared. So did the culture that created them. As Clovis people settled into different ecological zones, the culture split into separate groups, each adapting to its own separate environment. The end of the Clovis phase marked the beginning of enormous social, cultural, and linguistic diversity that characterized the next 10,000 years” (Smithsonian, 2013).

Archaic Period (8500 B.C. – A.D. 1774)

The Archaic Period in Washington is marked by a wide diversity in lifeways, reflecting the numerous ecological niches and resources available to the native people. This diversity in economy and technology can be explained by societies adapting to the various regional ecologies within the Washington region. Collectively, the archaeological record shows that the ’subsistence patterns of American Indians included hunting large game in colder climates, as well as exploiting fish, plants, and small game resources where they were available. Although game and fish resources were important to the diet of local native people, so were plant resources, particularly with respect to food, medicine, cordage, and rope, and a variety of other applications. “Although Northwest Indians were not agricultural, it is clear that they also understood that fertilizer improved the growth of subsequent crops; ash in tobacco plots and seaweed in clover beds were common. Studies of camas plot exploitation suggests an understanding of the benefits of transplanting, weeding, and aerating the soil (Boyd, 1999).

The regionally diverse populations of Washington, both in the Paleoindian and Archaic epochs, are understood collectively to be hunters and gatherers. The variability of their ecological environments, whether coastal, riparian, or desert, influenced their technologies, languages, economies, and lifeways (Sturtevant, 1990).

As with most northwest native groups living in and adapting forested environments, prescribed burning of forests and grasslands (or “pyroculture”) was carried out to influence game animal behavior for easier hunting and to create clearings where flora resources could flourish. During “deer drives,” game animals could be essentially funneled into selected areas by setting peripheral fires around herds, driving them into areas where they could be easily ambushed.

Also, prescribed burns in the late fall and early winter would create clearings with nutrient rich soils where vegetation could flourish during the spring and summer. This served to attract prey species that foraged on the understory species as well as provided a garden where edible plants could be harvested. In the Puget Sound ecoregion, bunchgrass, blackberry, camas, acorns, and various types of roots and ferns were favored. The focus of this technology was similar in the Cascade ecoregion pyro-cultural practices. Coastal native people seemed to focus prescribed burning on deer drives (Boyd, 1999) (Sturtevant, 1990).

Although the timelines for American Indian prehistory vary by region, a reliable 5-phase model has been created for the western Plateau region of Washington and is summarized below.

Clovis Phase (10000 – 8500 B.C.)

The Clovis Phase took place during the end of the Pleistocene epoch and the beginning of the warmer trends of the Early Holocence. Big game hunting, particularly the hunting of bison using spear technology with large lanceolate projectile points, was common. The now extinct North American megafauna, such as camel, mastodon, and horses, were also hunted into the early Archaic period, as reflected in the archaeological record. Early seed milling and the procurement of fish occurred during this phase as well. Sites associated with this phase have low artifact densities. Diagnostic lanceolate and fluted projectile point technologies are indicative of this period (Vaughn & Scott, 2012) (Jenkins, 2004).

Windust Phase (8500 – 6000 B.C.)

This phase is understood in the archeological record to include tabular flake and prismatic blade technology. The cultural material includes a large percentage of leaf-shaped projectile points, as well as diagnostic lanceolate points. Generalized hunter-gatherer lifeways were typical of this phase, where occupation patterns were influenced by the seasonal availability of exploitable resources.

Other tools from this phase include cobble tools, scrapers, blades and bone artifacts. As opposed to the Paleoindian phase, where megafauna were highly favored as food sources, smaller game and riparian resources were more intensely exploited during this phase. These resources included elk, deer, antelope, beaver, rabbit, and river mussel and are indicated by faunal remains and cultural material including a large percentage of leaf-shaped projectile points as well as diagnostic lanceolate points. The people of this phase were organized into highly mobile bands. Caves and rock shelters, including the Windust Caves and Marmes Rockshelter, were used as temporary and seasonal dwellings (Vaughn & Scott, 2012) (Washington State University, 2016b).

Vantage Phase (6000 – 2500 B.C.)

The Vantage Phase is a localized (western Plateau) manifestation of Old Cordilleran culture. The people of this phase increasingly depended on riparian resources, most notably fish. Leaf-shaped and side-notched projectile point technology is associated with the Vantage Phase, as indicated in the archaeological record. As with the Windust Phase, Washington's native people of this time would have been organized in small bands, focused on foraging and hunting for smaller game as it presented itself. This phase is marked by a general lack of specialization in resource procurement, although a pattern of fish and shellfish exploitation was established.

Pebble tools, scrapers, Cascade-type projectile points, leaf-shaped blades, and Windust points are associated with the Vantage Phase as is the limited use of milling implements for processing foraged seeds (Vaughn & Scott, 2012) (University of Washington, 2015).

Frenchman Springs Phase (2500 – 500 B.C.)

The Frenchman Springs Phase is understood in the context of a shift in archaeological assemblages and regional occupation. Assemblages for this phase include split-stemmed and contracting-stemmed projectile points. It is believed that these changes reflect the ecological shift towards a mesic environment, where shallow ponding brought with it seasonal waterfowl and small game resources. Semi-subterranean houses and seasonal camps for hunting and foraging are also associated with the Frenchman Springs Phase.

Cobble tools, scrapers, drills, blades, and chert stemmed-points are associated with this phase as are net sinkers, milling implements, needles, awls, decorative beads and pendants, mats and cordage. Medium and large mammals were hunted, with an increasing dependence on smaller mammals such as rabbit, as well as riverine resources such as fish and mussels. Seeds, roots, and berries were foraged, adding to the diversity of the local diet (Vaughn & Scott, 2012) (University of Washington, 2015).

Cayuse Phase (500 B.C. – A.D. 1774)

Included in the archaeological record for the Cayuse phase are lanceolate and pentagonal blades, scrapers, drills, small corner and side-notched projectile points, milling implements, net sinkers, awls, needles and decorative beads, and pendants, mats, and cordage. This phase's settlement, resource use, and dwelling patterns are similar to the Frenchman Springs Phase with emphasis on exploiting salmon and root gathering. Hunting was primarily done in the fall and winter while root gathering was a summer activity. Winter pithouses, semi-subterranean dwellings, and long-distance trade are associated with the Cayuse Phase (Vaughn & Scott, 2012) (University of Washington, 2015).

8.1.11.5. Federally Recognized Tribes of Washington

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are 29 federally recognized American Indian tribes in Washington. The location of federally recognized tribes are highlighted in bold in Figure 8.1.11-2. The other tribes depicted on the figure are general locations of tribes that were known to exist in this region of the United States, but are not officially federally recognized.

Table 8.1.11-2: List of Federally Recognized Tribes of Washington

Chehalis Confederated Tribes	Colville Confederated Tribes	Cowlitz Indian Tribe
Hoh Tribe	Jamestown S'Klallam Tribe	Kalispel Tribe
Lower Elwha Klallam Tribe	Lummi Nation	Makah Tribe
Muckleshoot Tribe	Nisqually Tribe	Nooksack Tribe
Port Gamble S'Klallam Tribe	Puyallup Tribe	Quileute Tribe
Quinault Indian Nation	Samish Indian Nation	Sauk-Suiattle Tribe
Shoalwater Bay Tribe	Skokomish Tribe	Snoqualmie Tribe
Spokane Tribe	Squaxin Island Tribe	Stillaguamish Tribe
Suquamish Tribe	Swinomish Tribe	Tulalip Tribes
Upper Skagit Tribe	Yakama Nation	

Source: (Governor's Office of Indian Affairs, 2016) (National Congress of State Legislatures, 2016) (GPO, 2016)

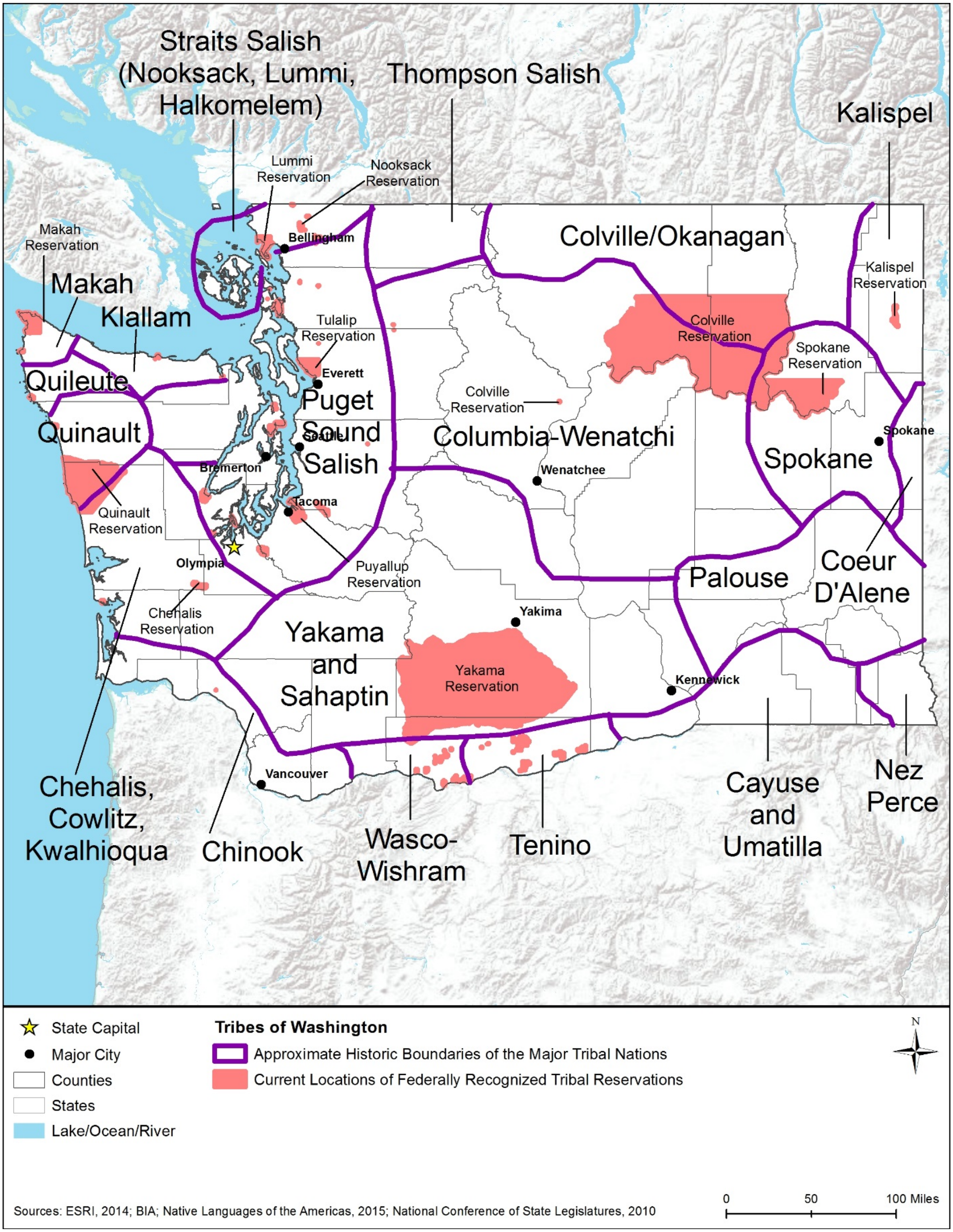


Figure 8.1.11-2: Federally Recognized Tribes in Washington

8.1.11.6. Significant Archaeological Sites of Washington

As reported in Section 8.1.11.3, there are 54 archaeological sites in Washington listed in the NRHP. Table 8.1.11-3presents 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 are listed on the NPS NRHP website (http://www.nps.gov/nr/) (NPS, 2015i).

Table 8.1.11-3: NRHP Listed Archaeological Sites in Washington

Closest City	Site Name	Type of Site
Asotin	Snake River Archeological District	Historic - Aboriginal, Prehistoric
Blaine	Si’ke village with historic area called Tsi’lich	Historic, Historic - Aboriginal, Prehistoric
Brinnon	Seal Rock Shell Mounds (45JE15)	Prehistoric
Camano Island	Site 45-IS-2	Prehistoric
Camas	Parkersville Site	Historic - Aboriginal, Prehistoric
Cheney	Turnbull Pines Rock Shelter	Prehistoric
Cheney	Upper Kepple Rockshelters (45SP7)	Prehistoric
Chimacum	Kuhn Spit Archeological Site	Prehistoric
Curtis	Wolfenbarger Site	Historic, Historic - Aboriginal, Prehistoric
DuPont	Sequalitchew Archeological Site	Prehistoric
Ford	Long Lake Pictographs	Historic - Aboriginal, Prehistoric
Forks	Wedding Rock Petroglyphs	Prehistoric
Hay	Henley Site	Prehistoric
Hoodsport	Big Creek Archeological Site--45MS100	Prehistoric
Husum	Rattlesnake Creek Site	Prehistoric
Kettle Falls	Hudson’s Bay Company Gristmill Site on Colville River	Historic
Kettle Falls	Kettle Falls District	Historic - Aboriginal, Prehistoric
La Push	Ozette Indian Village Archeological Site	Historic - Aboriginal, Prehistoric
Lyle	Rowland Basin Site	Historic - Aboriginal, Prehistoric
Lyons Ferry	Marmes Rockshelter	Prehistoric
North Bonneville	North Bonneville Archeological District	Historic, Historic - Aboriginal, Prehistoric
Pasco	Allen Rockshelter	Historic - Aboriginal, Prehistoric
Pasco	Lower Snake River Archaeological District	Historic - Aboriginal, Prehistoric
Pasco	Strawberry Island Village Archeological Site	Historic - Aboriginal, Prehistoric
Paterson	Telegraph Island Petroglyphs	Prehistoric
Potlatch	Taba Das	Historic - Aboriginal, Prehistoric
Prosser	Glade Creek Site	Prehistoric

Closest City	Site Name	Type of Site
Pysht	Hoko River Archeological Site	Prehistoric
Quilcene	Quilcene-Quinault Battleground Site	Historic - Aboriginal
Redmond	Marymoor Prehistoric Indian Site	Historic - Aboriginal, Prehistoric
Richland	Hanford Island Archeological Site	Historic - Aboriginal, Prehistoric
Richland	Hanford North Archeological District	Historic - Aboriginal, Prehistoric
Richland	Locke Island Archeological District	Historic - Aboriginal, Prehistoric
Richland	Rattlesnake Springs Sites	Historic - Aboriginal, Prehistoric
Richland	Ryegrass Archeological District	Prehistoric
Richland	Snively Canyon Archeological District	Prehistoric
Richland	Wooded Island Archeological District	Historic - Aboriginal, Prehistoric
Richland	Savage Island Archeological District	Historic, Prehistoric
Richland	Tri-Cities Archaeological District	Historic - Aboriginal, Prehistoric
Richland	Paris Archeological Site	Historic - Aboriginal, Prehistoric
Seattle	Duwamish Number 1 Site	Historic - Aboriginal, Prehistoric
Sekiu	Hoko River Rockshelter Archeological Site	Prehistoric
Sequim	Manis Mastodon Site	Prehistoric
Soap Lake	Mesa 36	Prehistoric
Starbuck	Palouse Canyon Archaeological District	Historic - Aboriginal, Prehistoric
Stehekin	Buckner Homestead Historic District	Historic
Suquamish	Old-Man-House Site (45KP2)	Historic - Aboriginal, Prehistoric
The Dalles	Wishram Indian Village Site	Prehistoric
Walker	Burr Cave	Prehistoric
Warden	Lind Coulee Archaeological Site	Prehistoric
Wenatchee	Wenatchee Flat Site	Historic - Aboriginal, Prehistoric
Wenatchee	Tekison Cave	Prehistoric
Wilbur	Goose Creek Rockshelter	Prehistoric
Windust	Windust Caves Archaeological District	Historic - Aboriginal, Prehistoric

Washington State Cultural Resources Database and Tools

Washington Department of Archaeology and Historic Preservation (DAHP)

The Washington Department of Archaeology and Historic Preservation works to administer programs for the preservation state's archaeological and historic resources. The office is responsible for regulatory oversight of archaeological activities, overseeing preservation programs, and maintaining archaeological and historical resources. A list of all NRHP nominations is available on the SHPO website (http://www.dahp.wa.gov/) for review as well as nomination forms and documents (Washington State Department of Archeology & Historic Preservation, 2015e).

Washington State University – Department of Anthropology

Washington State University, Anthropological Department provides graduate and undergraduate degrees in bioanthropology, archaeology, cultural anthropology, and linguistics. The University's Museum of Anthropology curates archaeological and ethnographic collections from the area and is the repository for all collections resulting from cultural studies conducted by federal, state, and counties museums in eastern Washington. The Department maintains records for 700 sites on their website at http://www.archaeology.wsu.edu/ArchRepository/index.html (Washington State University, 2016c)

Association for Washington Archaeology

The Association for Washington Archaeology is a non-profit organization dedicated to the preservation and protection of Washington's archaeological and historic resources. The Association publishes a quarterly newsletter and a yearly journal concerning current topics related to Washington archaeology, and is active in influencing local cultural resource .management legislation. For more information on becoming an affiliate of the Washington Archaeological Society, visit the website (http://www.washingtonarchaeology.com/about.html). (Association for Washington Archaeology, 2016)

Source: (NPS, 2015i)

8.1.11.7. Historic Context

In 1579, English explorer and privateer Sir Francis Drake may have sailed north along the Pacific Ocean as far as present-day Washington, naming the land New Albion, and claiming it for England (Washington Secretary of State, 2015b). The first European known to have sighted the coast of Washington is a Spanish mariner, Juan Jose Perez Hernandez, aboard the frigate *Santiago* in 1774 to investigate Russian and British activities in the region. He returned the following year "with "Spanish explorers Bruno Heceta and Bodega y Quadra [who] went ashore at what is now Point Grenville, near the Hoh River on the Olympic Peninsula of Washington" (Washington Secretary of State, 2015c). The name "Oregon" was first used in 1779, and would apply to the entire area, including Washington, until the creation of the Washington Territory in 1853 (Washington Secretary of State, 2015d).

The Columbia River helped facilitate commerce, particularly the fur trade, during the late 18th and early 19th centuries. Lewis and Clark's Corps of Discovery expedition reached the mouth of the Columbia in 1805 (Washington Secretary of State, 2015e). In 1818, the United States and England signed a treaty agreeing to jointly occupy the Pacific Northwest, and this agreement lasted for several decades (Washington Secretary of State, 2015f). In 1833, the first school was established in Washington, and in the early 1840s the Oregon Trail was "opened" through initial exploration and mapping, commencing a massive migration of settlers to the Pacific Northwest (Washington Secretary of State, 2015g) (Washington Secretary of State, 2015h).

The first American settlement north of the Columbia River occurred in 1846 near the southern portion of Puget Sound, and a grist mill and lumber mill were soon established (Washington Secretary of State, 2015i). On November 28, 1853, the Washington Territory was established, created from land formerly included in the Oregon Territory, and in 1855, gold was discovered, which sparked further westward immigration and conflicts between American Indians and white settlers (Washington Secretary of State, 2015j) (Washington Secretary of State, 2015k). While the Washington Territory was far removed from the action of the Civil War, Indian conflicts within the territory during the same period resulted in considerable casualties on both sides. Washington became the 42nd state to join the Union on November 11, 1889 (Washington Secretary of State, 2015l).

The completion of the northern transcontinental railroad lines that reached Washington, including the Great Northern Railway and the Northern Pacific Railway, facilitated growth that continued into the early 20th century (HistoryLink, 2010). Timbering remained very important into the 20th century, as did maritime related industries such as fishing and canning, with historic resources relating to these industries still existing today. Additional industries also grew during the early 20th century, including the aviation industry with the founding of Boeing in Seattle in 1917. During World War II (WWII), military bases were created in Washington, and citizens supported the war effort both domestically and abroad (HistoryLink, 2003).

Washington has 1,524 NRHP listed sites, as well as 24 NHL (NPS, 2014e). Washington contains no National Heritage Areas (NPS, 2015h). Figure 8.1.11-3 shows the location of NRHP sites within Washington.[127]

[127] See Section 8.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

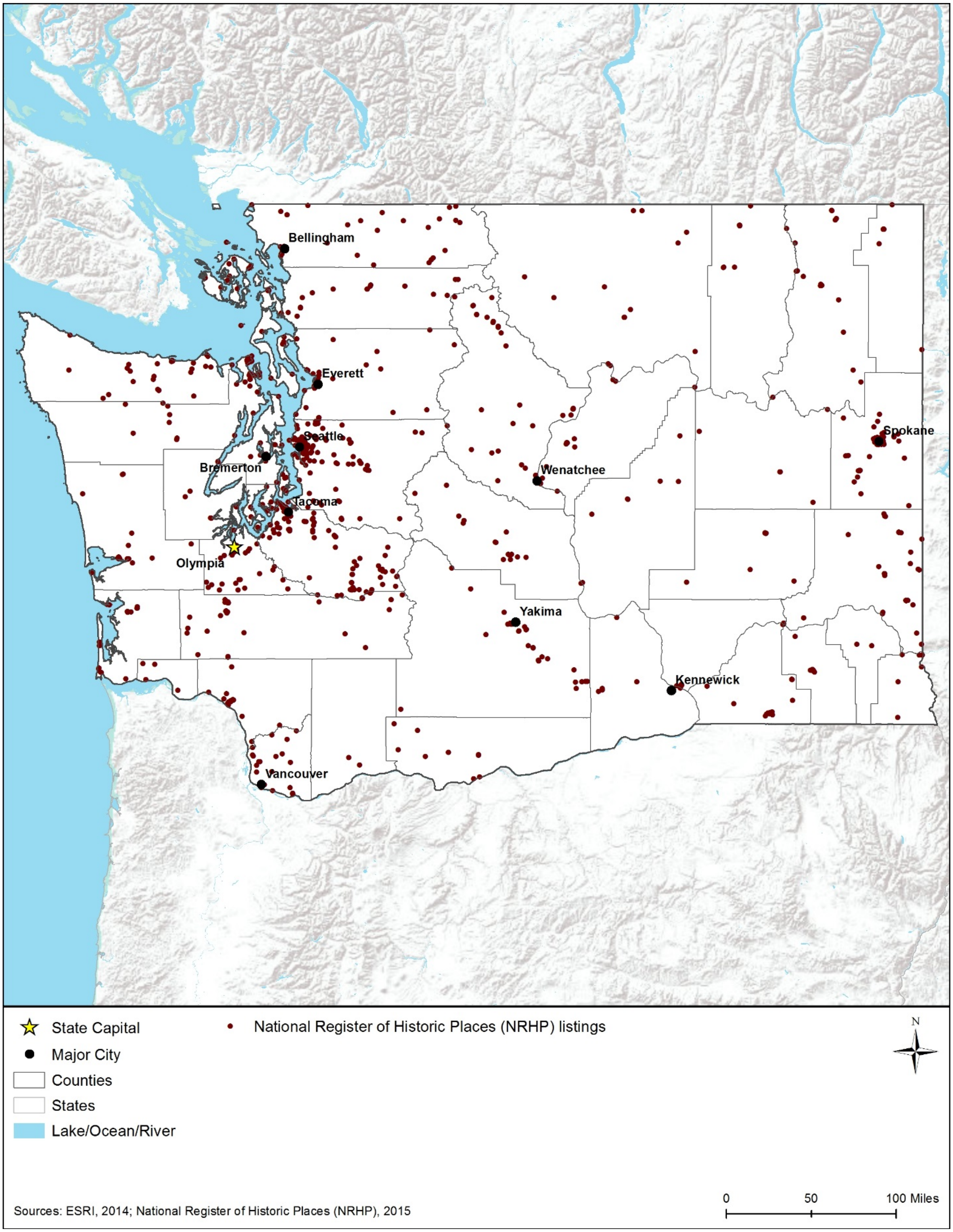


Figure 8.1.11-3: National Register of Historic Places (NRHP) Sites in Washington

8.1.11.8. Architectural Context

Early non-indigenous architecture in Washington consisted of utilitarian structures, such as trading posts and fortifications, which have generally not survived. Additional property types included those associated with agricultural production and subsistence, maritime pursuits, furring, milling, and transportation (Washington State Department of Archaeology & Historic Preservation, 2014). Late 19th and early 20th century farmhouses were generally “either front or side gable, vernacular style houses often…T-shaped with a side extension from the gabled section…built of wood with simple detailing of front porches and corner boards” (National Register of Historic Places, 1995). Industrial buildings are common as well and “the Georgetown Steam Plant in Seattle and the Milwaukee Railroad Yard Site in South Cle Elum are just two examples” (Washington State Department of Archaeology & Historic Preservation, 2014). Waterfront structures relating to the fishing and canning industries are common as well.

“False front” buildings were common in the early stages of town development and generally date from 1880 to 1910 (Washington State Department of Archaeology & Historic Preservation, 2015a). These were hastily constructed buildings of logs or simple framing, with flat, wood-framed façades meant to give the appearance of an urban dwelling and provide room for large signage. Depending on the settlement, the building would potentially be upgraded or replaced. If the settlement failed, buildings were simply abandoned (Heath, 1989). The Tiger Store (1912) in Tiger, WA is an example of this building type (Washington State Department of Archaeology & Historic Preservation, 2015a).

As settlements development and began to grow, particularly starting in the middle of the 19th century, decorative architectural styles began to evolve. Romantic Era styles, such as Carpenter Gothic were popular starting in the 1850s, with Italianate becoming popular starting in the 1870s. As the Romantic Era began to wane, Victorian styles grew in popularity. Examples include Second Empire, Queen Anne, Chateauesque, and Shingle Style. Starting in the early 20th century, the Prairie style became popular and can be seen on house types such as Foursquares and bungalows. The Craftsman style also became popular, particularly on bungalows, which originated on the west coast before spreading east (Washington State Department of Archaeology & Historic Preservation, 2015b). Following WWII, Minimal Traditional houses, also known as WWII Era Cottages, were built for returning soldier and their families. These houses were built in great numbers, often in speculative developments, and were a precursor to the ranch house. (Washington State Department of Archaeology & Historic Preservation, 2015c). Moderne styles were built, including Streamline Modern, Art Deco, Art Moderne, and International. These styles were common during the Great Depression and were often constructed through New Deal work relief programs (McAlester, 2013).

Figure 8.1.11-4: Representative Architectural Styles of Washington

- Top Left – Fox Theater (Seattle, WA) – (Historic American Buildings Survey, 1933a)
- Top Right – Wirt House (Oysterville, WA) – (Historic American Buildings Survey, 1933b)
- Right Middle – Paradise Inn (Paradise, WA) – (Historic American Buildings Survey, 1933c)
- Bottom – Grand Coulee Dam Powerplant Complex (Grand Coulee, WA) – (Historic American Engineering Record, 1968)

8.1.12. Air Quality

8.1.12.1. 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[128] 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)[129] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[130] This section discusses the existing

[128] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[129] Equivalent to 1 milligram per liter (mg/L)
[130] 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)

air quality in Washington. The USEPA designates areas within the United States as attainment,[131] nonattainment,[132] maintenance,[133] or unclassifiable[134] depending on the concentration of air pollution relative to ambient air quality standards (USEPA, 2015g). 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.

The state of Washington has eight separate and distinct air regulatory authorities: the Department of Ecology Air Quality Program, the Benton Clean Air Agency (BCAA), Northwest Clean Air Agency (NWCAA), Olympic Region Clean Air Agency (ORCAA), Puget Sound Clean Air Agency (PSCAA), Southwest Clean Air Agency (SWCAA), Spokane Regional Clean Air Agency (SRCAA), and the Yakima Regional Clean Air Agency (YRCAA) (Washington Department of Ecology, 2016b). USEPA Region 10 manages the air quality within Indian reservations throughout the state, following the Federal Air Rules for Reservations. These rules follow the federal requirements established by USEPA.

8.1.12.2. Specific Regulatory Considerations for the Department of Ecology Air Quality Program

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[135] or secondary,[136] 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, 2016c). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air

[131] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant. (USEPA, 2015g)
[132] 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).
[133] 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)
[134] 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)
[135] 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. (Washington Secretary of State, 2015b)
[136] 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. (Washington Secretary of State, 2015b)

Pollutants (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. Appendix E presents a list of federally regulated HAPs.

The Washington DOE contains offices in the Northwest, Central, and Eastern regions of Washington. All of the Washington DOE's regional offices follow the Washington Administrative Code (WAC).

In conjunction with the federal NAAQS, Washington maintains its own air quality standards, the Washington Ambient Air Quality Standards (WAAAQS). Table 8.1.12-1 presents an overview of the WAAAQS as defined by the Washington DOE.

Table 8.1.12-1: Washington Ambient Air Quality Standards

Pollutant	Averaging Time	Standards		Notes
		µg/m³	ppm	
CO	8-hour	10,000	9	Not to be exceeded more than once per year.
	1-hour	40,000	35	
Lead	3-month	0.15	-	Not to be exceeded.
NO_2	1-hour	-	0.1	98th percentile of 1-hour daily maximum average concentrations, averaged over 3 years.
	Annual	100	0.053	Annual mean.
PM_{10}	24-hour	150	-	Not to be exceeded more than once per year averaged over 3 years.
$PM_{2.5}$	Annual	12.0	-	Annual mean, averaged over 3 years.
	24-hour	35	-	98th percentile, averaged over 3 years.
O_3	8-hour	-	0.075	Annual fourth highest daily maximum 8-hr concentration, averaged over 3 years.
SO_2	1-hour	-	0.075	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
	3-hour	-	0.5	Not to be exceeded more than once per year.
	24-hour	-	0.14	Not to be exceeded more than once per year.
	Annual	-	0.02	Not to be exceeded in a calendar year.

Source: (Washington Department of Ecology, 2015n).

Title V Operating Permits/State Operating Permits

- Washington 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). WAC Chapter 93-401 describes the applicability of Title V operating permits (Washington Department of Ecology, 2015n). Washington 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 8.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 8.1.12-2: Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Criteria Pollutant[a]	100
Single HAP	10
Total/Cumulative HAPs	25

Source: (USEPA, 2014b)

[a] Sources in nonattainment areas will have lower thresholds for some criteria pollutants depending on the classification of the nonattainment area.

Exempt Activities

Select activities and units, as defined by WAC 173-401-532 (Categorically Exempt Insignificant Emission Units) and WAC 173-401-533 (Units and Activities Defined as Insignificant on the Basis of Size or Production Rate), are exempt from the registration and permitting provisions of WAC 173-401-300 (Applicability) for Washington DOE issued operating permits. The following activities and units are exempt from operating permitting requirements:

- "…Internal combustion engines for propelling or powering a vehicle…;
- Combustion source less than five million British thermal unit (Btu)/hr. exclusively using natural gas, butane, propane and/or liquefied petroleum gas;
- Combustion source, less than five hundred thousand Btu/hr., using any commercial fuel containing less than 0.4% by weight sulfur for coal or less than 1% by weight sulfur for other fuels;
- Combustion source, of less than one million Btu/hr. if using kerosene, No. 1 or No. 2 fuel oil…
- Combustion turbines, of less than 500 HP." (Washington Department of Ecology, 2015n)

Temporary Emissions Sources Permits

Washington DOE can issue temporary permits for emissions from similar operations by the same source owner or operator at multiple temporary locations. WAC Chapter 93-401-635 (Temporary Sources) states, "The operation must be temporary and involve at least one change of location during the term of the permit. No affected source[137] may be permitted as a temporary source." (Washington Department of Ecology, 2015n)

State Preconstruction Permits

Washington DOE requires a Notice of Construction permit under WAC Chapter 93-400-110 (New Source Review for Sources and Portable Sources) for new sources or for the modification of an existing source that will cause an increase in criteria pollutants in the air, or if a new pollutant is being introduced (Spencer, Air Permitting Specialist, 2015a).

[137] Affected source: "A source that includes one or more affected units that are subject to emission reduction requirements or limitations under Title IV [The Acid Rain Program] of the CAA." (Washington Secretary of State, 2015a).

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, 2013c). An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and (e), federal actions "in response to emergencies which are typically commenced on the order of hours or days after the emergency" and actions "which are part of part of a continuing response to emergency or disaster" that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (GPO, 2010).

The estimated pollutant emissions are compared to *de minimis*[138] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 8.1.12-3). As a result, lower *de minimis* thresholds for VOCs and NO_X could apply depending on the attainment status of a county.

Table 8.1.12-3: *De Minimis* Levels

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

Source: (GPO, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 8.1.12-3, 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 8.1.12-3, 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

[138] Small amount or minimal.

new violation of the NAAQS. To demonstrate conformity[139], the agency would have to fulfill one or more of the following:

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

State Implementation Plan Requirements

The Washington SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Washington's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Washington's SIP actions are codified under 40 CFR Part 52 Subpart WW. A list of all SIP actions for all six criteria pollutants can be found on the USEPA's website (http://yosemite.epa.gov/R10/AIRPAGE.NSF/a853080dfbf1a78588256b6e0003579e/85661e344ea2711a88257be200663044!OpenDocument).

8.1.12.3. Specific Regulatory Considerations for the BCAA

National and State Ambient Air Quality Standards

The BCAA does not maintain any ambient air quality standards. Instead, the BCAA adopted the federal NAAQS (Benton Clean Air Agency, 2015a).

Title V Operating Permits/State Operating Permits

- The BCAA 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). The WAC Chapter 93-401 (Operating Permit Regulation) describes the applicability of Title V operating permits (Washington State Legislature, 2015e). The BCAA requires Title V operating permits under the Air Operating Permit program for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 8.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

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

Exempt Activities

The BCAA follows regulations set under the WAC (Priddy, 2015). Select activities and units, as defined by WAC 173-401-532 (Categorically Exempt Insignificant Emission Units) and WAC 173-401-533 (Units and Activities Defined as Insignificant on the Basis of Size or Production Rate), are exempt from the registration and permitting provisions of WAC 173-401-300 (Applicability) for BCAA issued operating permits. The following activities and units are exempt from operating permitting requirements:

- "…Internal combustion engines for propelling or powering a vehicle…;
- Combustion source less than five million British thermal unit(Btu)/hr. exclusively using natural gas, butane, propane and/or liquefied petroleum gas;
- Combustion source, less than five hundred thousand Btu/hr., using any commercial fuel containing less than 0.4% by weight sulfur for coal or less than 1% by weight sulfur for other fuels;
- Combustion source, of less than one million Btu/hr. if using kerosene, No. 1 or No. 2 fuel oil;
- Combustion source, not greater than five hundred thousand Btu/hr. if burning used oil and not greater than four hundred thousand Btu/hr…; and
- Combustion turbines, of less than 500 horsepower." (Washington State Legislature, 2015e)

Temporary Emissions Sources Permits

The BCAA can issue temporary permits for emissions from similar operations by the same source owner or operator at multiple temporary locations. WAC Chapter 93-401-635 (Temporary Sources) states, "The operation must be temporary and involve at least one change of location during the term of the permit. No affected source[140] may be permitted as a temporary source" (Washington State Legislature, 1993).

State Preconstruction Permits

The BCAA requires a Notice of Construction permit[141] under WAC Chapter 93-400-110 (New source review for Sources and Portable Sources) for new sources or for the modification of an existing source that will cause an increase in criteria pollutants in the air, or if a new pollutant is being introduced (Spencer, Air Permitting Specialist, 2015a) (Benton Clean Air Agency, 2015b).

General Conformity

The BCAA follows the federal General Conformity regulations and does not maintain its own. See section 8.1.12.2 for a general discussion of the Federal General Conformity laws.

State Implementation Plan Requirements

The BCAA SIP is composed of many related actions to ensure ambient air concentrations of criteria pollutants comply with the NAAQS. The BCAA's SIP is a conglomeration of separate actions taken for each of the pollutants. The BCAA's SIP actions are codified under 40 CFR

[140] Affected source: "A source that includes one or more affected units that are subject to emission reduction requirements or limitations under Title IV [The Acid Rain Program] of the CAA." (Washington Secretary of State, 2015a).
[141] Notice of Construction (NOC) Permit: A preconstruction permit required for "businesses that are new, replacing, or modifying emission control equipment, or are increasing their air pollutant emissions… An NOC limits the business's air pollutant emissions."

Part 52 Subpart WW. A list of all SIP actions for all six criteria pollutants can be found on the USEPA's website (http://yosemite.epa.gov/R10/AIRPAGE.NSF/a853080dfbf1a78588256b6e0003579e/85661e344ea2711a88257be200663044!OpenDocument).

8.1.12.4. Specific Regulatory Considerations for the NWCAA

National and State Ambient Air Quality Standards

In addition to adopting the NAAQS outlined in Appendix E, the NWCAA also maintains local standards for fluorides, hydrocarbons, and particulate fallout standards (see Table 8.1.12-4) (Agata McIntyre, 2015).

Table 8.1.12-4: Washington NWCAA Ambient Air Quality Standards

Pollutant	Averaging Time	Standards		Notes
		$\mu g/m^3$	ppm	
Particulate Fallout Standards	1-month	1.0×10^7	-	In an industrial area.
	1-month	5.0×10^6	-	In an industrial area if visual observations show a presence of wood waste and the volatile fraction of sample exceeds 70 percent.
	1-month	5.0×10^6	-	In residential and commercial areas.
	1-month	3.5×10^6	-	In residential and commercial areas if visual observations show the presence of wood waste and the volatile fraction of the sample exceeds seventy percent.
Hydrocarbons	3-hour	160	0.24	No more than once during the entire period: 6:00 am to 9:00 am from April 1 through October 31.
Fluoride Forage	Growing Season	-	40	Average for the growing season.
	Each month, more than two consecutive months	-	60	Each month for more than two consecutive months during the growing season.
	Any two consecutive months	-	80	More than once in any two consecutive months during the growing season.

Source: (Washington Northwest Clean Air Agency, 2015a) (Washington Northwest Clean Air Agency, 2015b)

Title V Operating Permits/State Operating Permits

- The NWCAA 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). NWCAA Section 322 (Air Operating Permit Program) describes the applicability of Title V operating permits (Washington Northwest Clean Air Agency, 2015a). The NWCAA 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 8.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

Select activities and units, as defined by NWCAA Section 300.4 (Emission Unit and Activity Exemptions), are exempt from the registration and permitting provisions of NWCAA Section 300 (New Source Review) for NWCAA issued Notice of Construction permits. The following activities and units are exempt from Notice of Construction permitting requirements:

- "…A project with combined aggregate heat input capacity from combustion units, less than or equal to any of the following:
  - Less than or equal to 500,000 British thermal units (Btu)/hr coal with less than or equal to 0.5% sulfur or other fuels with less than or equal to 0.5% sulfur;
  - Less than or equal to 500,000 Btu/hr used oil, per the requirements of WAC 70.94.610 (Burning Used Oil Fuel in Land-Based Facilities);
  - Less than or equal to 400,000 Btu/hr wood waste or paper;
  - Less than 1,000,000 Btu/hr kerosene, #1, or #2 fuel oil and with less than or equal to 0.05% sulfur; and
  - Less than or equal to 10,000,000 Btu/hr natural gas, propane, or liquefied petroleum gas…
- Emergency Stationary Compression Ignition Internal Combustion Engines[142]…;
- A new emissions unit that has an uncontrolled potential to emit below each of the threshold levels listed in Table 8.1.12-2. In addition, a modification to an existing emissions unit that increases the unit's actual emissions by less than each of the threshold levels listed in the Table 8.1.12-2 is exempt from new source review provided that the following conditions are met:
  - The owner or operator seeking to exempt a project from new source review under this section shall notify, and upon request, file a brief project summary with the NWCAA thirty (30) days prior to beginning actual construction on the project." (Washington Northwest Clean Air Agency, 2015a).

Table 8.1.12-5: Pollutant Threshold Level (TPY)

Pollutant	TPY	Notes
Total Suspended Particulates	1.25	---
$PM_{2.5}$	0.5	---
PM_{10}	0.75	---
Sulfur Oxides	2.0	---
Nitrogen Oxides	2.0	---
VOCs	2.0	Total 2.0
CO	5.0	---
Lead	0.005	---
Ozone Depleting Substances	1.0	Total 1.0

[142] Emergency Stationary Compression Ignition Internal Combustion Engines : "Any stationary internal combustion engine whose operation is limited to emergency situations and required testing and maintenance and operating less than 500 hours a year." (Washington Northwest Clean Air Agency, 2015a).

Pollutant	TPY	Notes
Taps	-	As specified in WAC 173-460 (Controls for New Sources of Toxic Air Pollutants)

Source: (Washington Northwest Clean Air Agency, 2015a)

Temporary Emissions Sources Permits

The NWCAA can issue temporary permits under NWCAA Section 301.2 (Temporary Sources) for "temporary sources not exempt under NWCAA 300.4 (Emission Unit and Activity Exemptions) or 300.5 (Exemptions Based on Emissions Thresholds), which locate at temporarily sites within the jurisdictions of the NWCAA. The NWCAA issues temporary permits for operations that do not cause a violation of the AAQs (Washington Northwest Clean Air Agency, 2015a).

State Preconstruction Permits

The NWCAA requires a Notice of Construction permit under NWCAA Section 300 (New Source Review) for new sources or for the modification of an existing source that will cause an increase in criteria pollutants in the air (Washington Northwest Clean Air Agency, 2015a).

General Conformity

The NWCAA follows the federal General Conformity regulations and does not maintain its own. See section 8.1.12.2 for a general discussion of the Federal General Conformity laws.

State Implementation Plan Requirements

The NWCAA SIP is composed of many related actions to ensure ambient air concentrations of criteria pollutants comply with the NAAQS. The NWCAA's SIP is a conglomeration of separate actions taken for each of the pollutants. The NWCAA's SIP actions are codified under 40 CFR Part 52 Subpart WW. A list of all SIP actions for all six criteria pollutants can be found on the USEPA's website:
http://yosemite.epa.gov/R10/AIRPAGE.NSF/a853080dfbf1a78588256b6e0003579e/85661e344ea2711a88257be200663044!OpenDocument.

8.1.12.5. Specific Regulatory Considerations for ORCAA

National and State Ambient Air Quality Standards

The ORCAA regulations do not establish local ambient air quality standards (Olympic Region Clean Air Agency, 2015). The ORCAA therefore adheres to the state standards outlined in section 8.1.12.2 and the NAAQS in Appendix E.

Title V Operating Permits/State Operating Permits

- The ORCAA 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). The ORCAA Regulation, Rule 5.1 (Operating Permit Program) describes the applicability of Title V operating permits. ORCAA 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 8.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

Under ORCAA Regulation, Rule 6.1(d), the following select sources are categorically exempt from requiring a notice of construction:

- "…brazing, soldering, plumbing…
- …Fuel burning equipment (not including incinerators) that…
    - is used solely for a private dwelling serving five families or less; or
    - has a maximum heat input rate of 5 MMBtu/hr or less if burning natural gas, propane, or LPG; or
    - has a maximum heat input rate of 0.5 MMBtu/hr or less if burning waste-derived fuels; or
    - has a maximum heat input rate of 1 MMBtu/hr or less if burning recycled or used oil …; or
    - has a maximum heat input rate of 1 MMBtu/hr or less if burning any other type of fuel and with less than or equal to 0.05% sulfur by weight
- All stationary gas turbines with a rated heat input < 10 million Btu per hour
- Stationary internal combustion engines having rated capacity
    - <50 horsepower output; or
    - <500 horsepower and used only for standby emergency power generation…" (Olympic Region Clean Air Agency, 2015)

Temporary Emissions Sources Permits

The ORCAA does not issue permits for temporary permits, but instead follows WAC 173-401 (Operating Permit Regulation) which allows agencies in Washington to issue permits for temporary sources (Olympic Region Clean Air Agency, 2015).

State Preconstruction Permits

ORCAA Regulation, Rule 6.1 (Notice of Construction Required) requires each source submit, and have approved, a notice of construction prior to commencing construction (Olympic Region Clean Air Agency, 2015).

General Conformity

The ORCAA follows the federal General Conformity regulations and does not maintain its own. See section 8.1.12.2 for a general discussion of the Federal General Conformity laws.

State Implementation Plan Requirements

The ORCAA has specific regulations, approved by USEPA, as part of the Washington SIP. A list of these regulations for complying with the Washington SIP can be found on the USEPA's website: http://yosemite.epa.gov/R10/AIRPAGE.NSF/a853080dfbf1a78588256b6e0003579e/85661e344ea2711a88257be200663044!OpenDocument.

8.1.12.6. Specific Regulatory Considerations for PSCAA

National and State Ambient Air Quality Standards

The PSCAA regulations do not establish local ambient air quality standards (Puget Sound Clean Air Agency, 2015). The PSCAA therefore adheres to the state standards outlined in section 8.1.12.2 and the NAAQS in Appendix E.

Title V Operating Permits/State Operating Permits

- The PSCAA 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). PSCAA Regulation I, section 7 adopts the applicability of Title V operating permits from Washington DOE (see section 8.1.12.2). (Puget Sound Clean Air Agency, 2015)

Exempt Activities

The following select activities are exempt from submitting a Notice of Construction, "provided that a complete notification is filed with the [Puget Sound Clean Air] Agency…

- …Relocation of the following portable facilities: asphalt batch plants, nonmetallic mineral processing plants, and concrete batch plants for which an Order of Approval has been previously issued by the [Puget Sound Clean Air] Agency…"

The following select activities are exempt from submitting a Notice of Construction…

- "…Fuel-burning equipment (except when combusting pollutants generated by a non-exempt source) having a rated capacity:
  - <10 million Btu per hour heat input burning exclusively distillate fuel oil, natural gas, propane, butane, biodiesel…
  - <0.5 million Btu per hour heat output burning waste-derived fuel…
  - <1 million Btu per hour heat input burning any other fuel.
- All stationary gas turbines with a rated heat input <10 million Btu per hour.
- Stationary internal combustion engines having a rated capacity:
  - <50 horsepower output…
  - …portable or standby units operated <500 hours per year…

- …Relocation of portable, stationary internal combustion engines or gas turbines for which an Order of Approval has been previously issued by the [Puget Sound Clean Air] Agency.
- All nonroad compression ignition engines subject to 40 CFR Part 89 and land-based nonroad compression engines subject to 40 CFR Part 1039…" (Puget Sound Clean Air Agency, 2015)

Temporary Emissions Sources Permits

PSCAA does not have local regulations for temporary source permits. Instead, pursuant to Regulation I section 6.01, the agency adopts the state permitting requirements (see section 8.1.12.2) (Puget Sound Clean Air Agency, 2015).

State Preconstruction Permits

In accordance with PSCAA Regulation I, section 6.03 (Notice of Construction), any new or modified source must have a Notice of Construction filled and approved prior to construction. (Puget Sound Clean Air Agency, 2015)

General Conformity

The PSCAA follows the federal General Conformity regulations and does not maintain its own. See section 8.1.12.2 for a general discussion of the Federal General Conformity laws.

State Implementation Plan Requirements

The PSCAA has specific regulations, approved by USEPA, as part of the Washington SIP. A list of these regulations for complying with the Washington SIP can be found on the USEPA's website:
http://yosemite.epa.gov/R10/AIRPAGE.NSF/a853080dfbf1a78588256b6e0003579e/85661e344ea2711a88257be200663044!OpenDocument.

8.1.12.7. Specific Regulatory Considerations for the SWCAA

National and State Ambient Air Quality Standards

The SWCAA regulations do not establish local ambient air quality standards. The SWCAA therefore adheres to the state standards outlined in section 8.1.12.2 and the NAAQS in Appendix E. (Washington Southwest Clean Air Agency, 2015a)

Title V Operating Permits/State Operating Permits

- The SWCAA 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). The SWCAA follows WAC Chapter 93-401 (Operating Permit Regulation), which describes the applicability of Title V operating permits (Washington State Legislature, 2015e). The SWCAA requires Title V operating permits under WAC Chapter 93-401 (Operating Permit Regulation) for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table

8.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

In addition to Title V operating permits, the SWCAA issues permits under SWCAA regulation 400-045 (Permit Application for Nonroad Engines) for nonroad engines except for the following:

- “Nonroad engine installations with an aggregate power rating less than 500 Horsepower…;
- Engines used to power portable equipment…; or
- Engines used to replace utility power on an emergency basis (< 30 days in duration).” (Washington Southwest Clean Air Agency, 2015a)

Exempt Activities

The SWCAA follows regulations set under the WAC (Washington Southwest Clean Air Agency, 2015b). Select activities and units, as defined by WAC 173-401-532 (Categorically Exempt Insignificant Emission Units) and WAC 173-401-533 (Units and Activities Defined as Insignificant on the Basis of Size or Production Rate), are exempt from the registration and permitting provisions of WAC 173-401-300 (Applicability) for SWCAA issued operating permits. The following activities and units are exempt from operating permitting requirements:

- “…Internal combustion engines for propelling or powering a vehicle…;
- Combustion source less than five million British thermal unit(Btu)/hr. exclusively using natural gas, butane, propane and/or liquefied petroleum gas;
- Combustion source, less than five hundred thousand Btu/hr., using any commercial fuel containing less than 0.4% by weight sulfur for coal or less than 1% by weight sulfur for other fuels;
- Combustion source, of less than one million Btu/hr. if using kerosene, No. 1 or No. 2 fuel oil;
- Combustion source, not greater than five hundred thousand Btu/hr. if burning used oil and not greater than four hundred thousand Btu/hr…; and
- Combustion turbines, of less than 500 horsepower.” (Washington State Legislature, 2015e)

SWCAA regulation 400-101(4) (Exempt equipment and activities) exempts the following unit from the permitting registration requirements of SWCAA regulation 400-100 (Registration Requirements):

- “…Internal combustion engines used for emergency service with a maximum aggregate power rating less than 200 horsepower…”

The SWCAA regulation 400-109(3)(c) (Exempt equipment and activities) exempts the following equipment and activities from the permitting registration requirements of SWCAA regulation 400-109 (Air Discharge Permit Applications):

- “Relocation of portable equipment that has an active air discharge permit from SWCAA allowing portable operation…;
- Emergency service internal combustion engines manufactured after January 1, 2008 and individually rated at less than 200 horsepower…;

- Emergency service internal combustion engines;
- Non-emergency internal combustion engines manufactured after January 1, 2008 in use at facilities with total engine capacity less than 500,000 horsepower-hours…" (Washington Southwest Clean Air Agency, 2015a)

Temporary Emissions Sources Permits

The SWCAA does not issue permits for temporary permits, but instead follows WAC 173-401 (Operating Permit Regulation) which allows agencies in Washington to issue permits for temporary sources (Washington Southwest Clean Air Agency, 2015b).

Preconstruction Permits

The SWCAA requires an Air Discharge permit, also known as a Notice of Construction permit, under SWCAA 400-109 (Applicability) for new sources or for the modification of an existing source that will cause an increase in criteria pollutants in the air (Washington Southwest Clean Air Agency, 2015a).

General Conformity

The SWCAA follows the federal General Conformity regulations and does not maintain its own. See section 8.1.12.2 for a general discussion of the Federal General Conformity laws.

Fugitive Dust Emissions

SWCAA Regulation 400-040(3) (Fugitive Emissions) indicates that reasonable precautions must be taken to prevent dust emissions. "If located in an attainment area and not impacting any nonattainment area, shall take reasonable precautions to prevent the release of air contaminants from the operation. If the emission unit has been identified as a significant contributor to the nonattainment status of a designated nonattainment area, shall be required to use reasonable and available control methods, which shall include any necessary changes in technology, process, or other control strategies to control emissions of the air contaminants for which nonattainment has been designated." (Washington Southwest Clean Air Agency, 2015a).

State Implementation Plan Requirements

The SWCAA SIP is composed of many related actions to ensure ambient air concentrations of criteria pollutants comply with the NAAQS. The SWCAA's SIP is a conglomeration of separate actions taken for each of the pollutants. The SWCAA's SIP actions are codified under 40 CFR Part 52 Subpart WW. A list of all SIP actions for all six criteria pollutants can be found on the USEPA's website: http://yosemite.epa.gov/R10/AIRPAGE.NSF/a853080dfbf1a78588256b6e0003579e/85661e344ea2711a88257be200663044!OpenDocument.

8.1.12.8. Specific Regulatory Considerations for the SRCAA

National and State Ambient Air Quality Standards

The SRCAA regulations do not establish local ambient air quality standards. The SRCAA therefore adheres to the state standards outlined in section 8.1.12.2 and the NAAQS in Appendix E. (Spokane Regional Clean Air Agency , 2015a)

Title V Operating Permits/State Operating Permits

- The SRCAA 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). SRCAA Regulation I, Article II, Section 2.14 (Washington Administrative Codes) adopts WAC 173-401 (Operating Permit Regulation), which describes the applicability of Title V operating permits (Spokane Regional Clean Air Agency , 2015b). The SRCAA 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 8.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

SRCAA Regulation I, Article V, Section 5.08(G) (Temporary and Portable Stationary Sources**)** exempts all nonroad compression ignition engines from the registration and permitting requirements of SRCAA Regulation I, Article V, Section 5.02 (Notice of Construction – When Required) (Spokane Regional Clean Air Agency , 2015b).

Temporary Emissions Sources Permits

SRCAA Regulation I, Article V, Section 5.08 (Temporary and Portable Stationary Sources) requires the owner of a portable stationary source located temporarily at sites in Spokane County to obtain a Notice of Construction permit and Application for Approval[143] the first time the source operates in Spokane County (Spokane Regional Clean Air Agency , 2015b).

State Preconstruction Permits

SRCAA Regulation I, Article V, Section 5.02 (Notice of Construction – When Required) requires the owner or operator of a source to submit a Notice of Construction application and receive approval before beginning the actual construction of a source (Spokane Regional Clean Air Agency , 2015b).

[143] Notice of Construction and Application for Approval: "A written application to permit construction of a new source, modification of an existing stationary source or replacement or substantial alteration of control technology at an existing stationary source." (Spokane Regional Clean Air Agency , 2015b).

General Conformity

The SRCAA follows the federal General Conformity regulations and does not maintain its own. See section 8.1.12.2 for a general discussion of the Federal General Conformity laws.

State Implementation Plan Requirements

The SRCAA SIP is composed of many related actions to ensure ambient air concentrations of criteria pollutants comply with the NAAQS. The SRCAA's SIP is a conglomeration of separate actions taken for each of the pollutants. The SRCAA's SIP actions are codified under 40 CFR Part 52 Subpart WW. A list of all SIP actions for all six criteria pollutants can be found on the USEPA's website (http://yosemite.epa.gov/R10/AIRPAGE.NSF/a853080dfbf1a78588256b6e0003579e/85661e344ea2711a88257be200663044!OpenDocument).

8.1.12.9. Specific Regulatory Considerations for the YRCAA

National and State Ambient Air Quality Standards

The YRCAA does not maintain any local ambient air quality standards. The agency instead implements both the state and federal ambient air quality, as outlined in the YRCAA Regulation 1, section 2.03 (Applicable State and Federal Regulations) (Yakima Regional Clean Air Authority, 2002).

Title V Operating Permits/State Operating Permits

- The YRCAA 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). Per YRCAA Regulation 1, section 4.04 (Air Operating Permits), the Yakima Region adheres to the applicability, requirements, and content of Washington's operating permits under WAC 173-401 (Operating Permit Regulation). The state 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 8.1.12-2). Permits issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

Sources which have actual emissions less than the *de minimis* thresholds shown in the Table 8.1.12-6 below, are exempt from registration.

Table 8.1.12-6: *De Minimis* Thresholds for Criteria Exempt Sources

Pollutant	Threshold (TPY)
CO	5.0
NO_X	2.0
SO_2	2.0
PM	1.25
PM_{10}	0.75
VOC	2.0
Lead	0.005

Source: (Yakima Regional Clean Air Authority, 2002)

The Yakima Region adopts regulations set under the WAC (Yakima Regional Clean Air Authority, 2002). Select activities and units, as defined by WAC 173-401-532 (Categorically Exempt Insignificant Emission Units) and WAC 173-401-533 (Units and Activities Defined as Insignificant on the Basis of Size or Production Rate), are exempt from the registration and permitting provisions of WAC 173-401-300 (Applicability) for issued operating permits. The following activities and units are exempt from operating permit requirements:

- "…Internal combustion engines for propelling or powering a vehicle…;
- "…Combustion source less than five million Btu/hr. exclusively using natural gas, butane, propane and/or [liquefied petroleum gas];
- Combustion source, less than five hundred thousand Btu/hr., using any commercial fuel containing less than 0.4% by weight sulfur for coal or less than 1% by weight sulfur for other fuels;
- Combustion source, of less than one million Btu/hr. if using kerosene, No. 1 or No. 2 fuel oil;
- Combustion source, not greater than five hundred thousand Btu/hr. if burning used oil and not greater than four hundred thousand Btu/hr.…; and
- Combustion turbines, of less than 500 horsepower." (Washington State Legislature, 2011)

Temporary Emissions Sources Permits

The Yakima Region has not established separate regulations from permitting temporary emission sources. Section 2.03 of YRCAA Regulation 1, adopts the Washington state general regulations for air pollution control (WAC 173-400), as well as operating permit regulations (WAC 173-401). The state can issue temporary permits for emissions for emissions from similar operations by the same source owner or operator at multiple temporary locations. (Washington State Legislature, 2011)

Preconstruction Permits

The YRCAA has not established local requirements for preconstruction permitting, and will therefore adhere to the state's requirements. WAC 173-400-110 (New Source Review for Sources and Portable Sources), requires new sources to submit a Notice of Construction for approval prior to commencing construction. This requirement does not apply to non-road engines. (Washington State Legislature, 2012)

General Conformity

The YRCAA follows the federal General Conformity regulations and does not maintain its own. See section 8.1.12.2 for a general discussion of the Federal General Conformity laws.

State Implementation Plan Requirements

The YRCAA has specific regulations, approved by USEPA, as part of the Washington SIP. A list of these regulations for complying with the Washington SIP can be found on the USEPA's website (http://yosemite.epa.gov/R10/AIRPAGE.NSF/a853080dfbf1a78588256b6e0003579e/85661e344ea2711a88257be200663044!OpenDocument).

8.1.12.10. Environmental Setting: Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Figure 8.1.12-1 and Table 8.1.12-7, below, present the nonattainment areas in Washington as of January 30, 2015. The year(s) listed in the table for each pollutant indicate when USEPA promulgated the standard for that pollutant; note that, for $PM_{2.5}$, PM_{10}, and CO, these standards listed are in effect. Table 8.1.12-7 contains a list of the counties and their respective current nonattainment status for each criteria pollutant. The year(s) listed in the table for each pollutant indicate when USEPA promulgated the standards for that pollutant. Unlike Table 8.1.12-7, Figure 8.1.12-1 does not differentiate between standards for the same pollutant. Additionally, given that particulate matter is the criteria pollutant of concern, PM_{10} and $PM_{2.5}$ merge in the figure to count as a single pollutant.

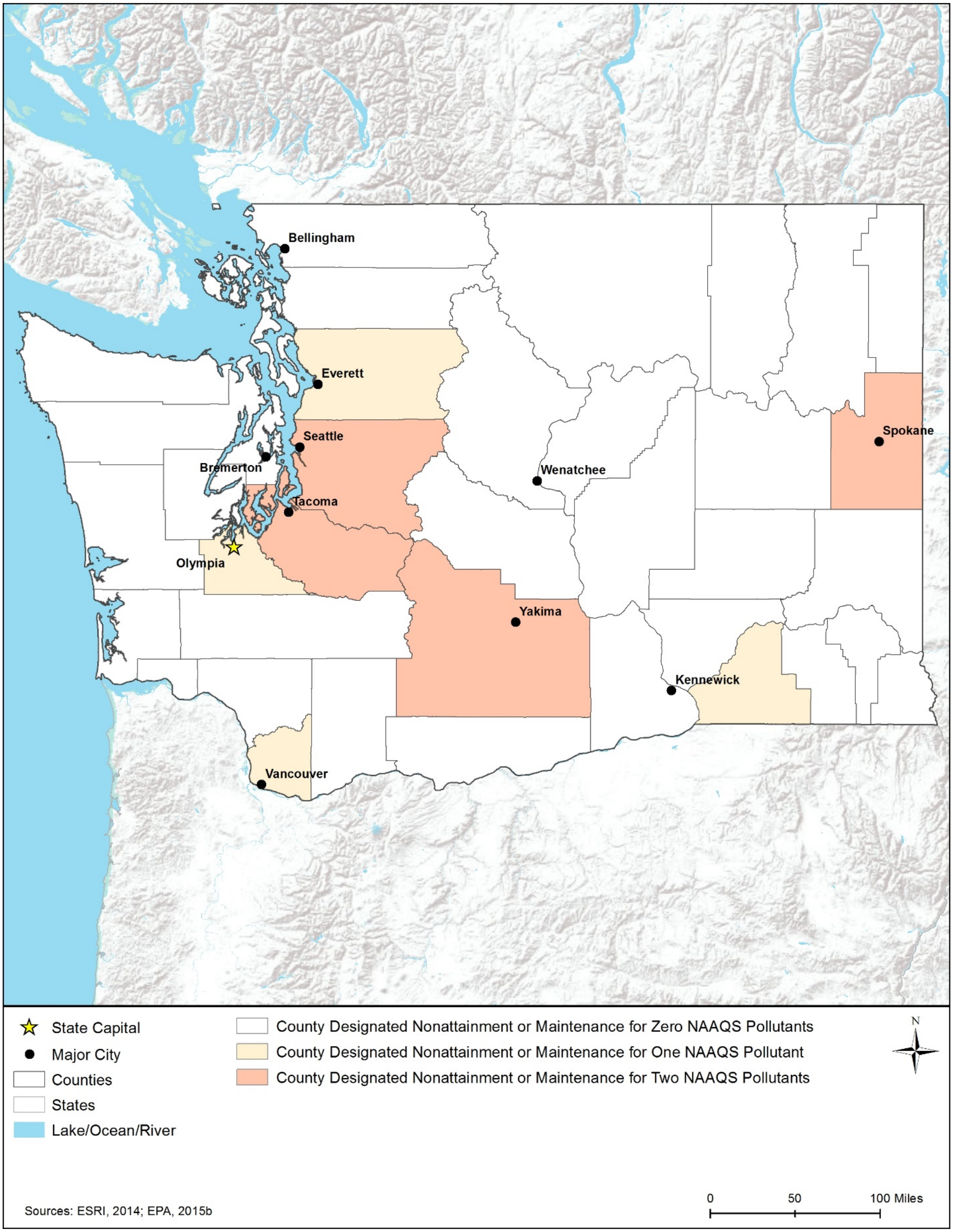


Figure 8.1.12-1: Nonattainment and Maintenance Counties in Washington

Table 8.1.12-7: Washington Nonattainment and Maintenance Areas by Pollutant Standard and County

County	Pollutant and Year USEPA Implemented Standard										
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$		O_3		SO_2	
	1971	1979	2008	1971	1987	1997	2006	1997	2008	1971	2010
Clark	M										
King	M				M						
Pierce	M				M		M				
Snohomish	M										
Spokane	M				M						
Thurston					M						
Walla Walla					M						
Yakima	M				M						

Source: (USEPA, 2015i)

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

Air Quality Monitoring and Reporting

Washington DOE and local clean air agencies measure air quality at more than 70 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network (Washington Department of Ecology, 2015o). The Department of Ecology prepares annual air monitoring network reports, which provide updates to monitoring sites, as well as identifies any exceedances of the NAAQS. Additionally, real-time pollution levels of O_3, PM_{10}, $PM_{2.5}$, and CO are on the Department of Ecology website: https://fortress.wa.gov/ecy/enviwa/.

Throughout 2014, the following counties have recorded exceedances of O_3 and PM_{10}, and $PM_{2.5}$. Within that timeframe, there have been no other exceedances of criteria pollutants, and all maintenance areas are currently in compliance (Washington Department of Ecology, 2015o).

Table 8.1.12-8: Washington Criteria Pollutant Exceedances Throughout 2014

Pollutant	County	# Exceedances
Ozone	Clark	1
	King	1
PM_{10}	Benton	1
	Stevens	1
$PM_{2.5}$	Chelan	3
	Clark	3
	King	2
	Pierce	2

Pollutant	County	# Exceedances
	Snohomish	4
	Spokane	2
	Yakima	4

Source: (Washington Department of Ecology, 2016c)

Air Quality Control Regions

USEPA classified all land in the United States as a Class I, Class II, or Class III Federal Air Quality Control Region (AQCR) (42 U.S.C. § 7470). Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size. Class I areas cannot be re-designated as Class II or Class III and are intended to maintain pristine air quality. Although USEPA developed the standards for a Class III AQCR, to date they have not actually classified any area as Class III. Therefore, any area that is not classified as a Class I area is, by default, automatically designated as a Class II AQCR (42 U.S.C. § 7472).

In a 1979 USEPA memorandum, the Assistant Administrator for Air, Noise, and Radiation (USEPA 1979) advised USEPA Regional Offices to provide notice to the Federal Land Manager (FLM) of any facility subject to the Prevention of Significant Deterioration (PSD) permit requirements and within 100 kilometers[144] of a Class I area. “The USEPA’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. If an action is considered major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (USEPA, 1992). “Historically, the USEPA 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[145] (the normal useful range of EPA-approved Gaussian plume models” (USEPA, 1992).

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

Washington contains eight Class I areas: Olympic National Park, North Cascades National Park, Pasayten Wilderness, Glacier Peak Wilderness, Alpine Lakes Wilderness, Mount Rainier National Park, Goat Rocks Wilderness, and Mount Adams Wilderness areas. Oregon has three Class I areas, Mount Hood Wilderness, Eagle Cap Wilderness, and Hells Canyon Wilderness areas, where the 100-kilometer buffer intersects Washington Counties. Idaho has one Class I area, the Hells Canyon Wilderness area, where the 100-kilometer buffer intersects Washington Counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 8.1.12-2 provides a map of Washington highlighting all relevant Class I areas and all areas within the 100-kilometer radiuses. The numbers next to each of the highlighted Class I areas in Figure 8.1.12-2 correspond to the numbers and Class I areas listed in Table 8.1.12-9.

Table 8.1.12-9: Relevant Federal Class I Areas

#[a]	Area	Acreage	State
1	Olympic National Park	892,578	WA
2	North Cascades National Park	503,277	WA
3	Pasayten Wilderness Area	505,524	WA
4	Glacier Peak Wilderness Area	464,258	WA
5	Alpine Lakes Wilderness Area	303,508	WA
6	Mount Rainier National Park	235,239	WA
7	Goat Rocks Wilderness Area	82,680	WA
8	Mount Adams Wilderness Area	32,356	WA
9	Mount Hood Wilderness Area	14,160	OR
10	Eagle Cap Wilderness Area	293,476	OR
11	Hells Canyon Wilderness Area	192,700	ID-OR

Source: (DOH, 2015e)

[a] The numbers correspond to the shaded regions in Figure 8.1.12-2

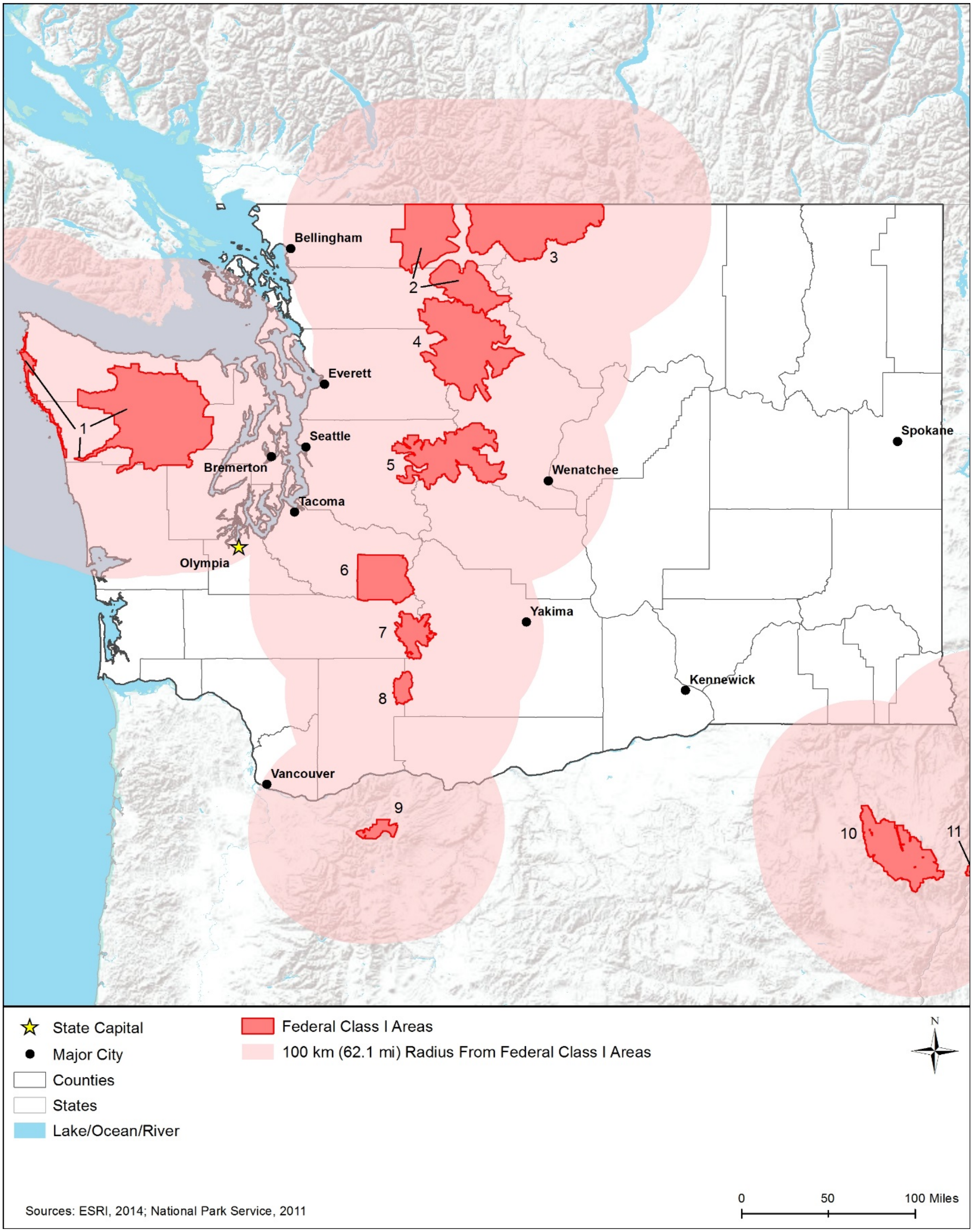


Figure 8.1.12-2: Federal Class I Areas With Implications for Washington

8.1.13. Noise

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

8.1.13.1. Definition of the Resource

Noise is caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012b). 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") (OSHA, 2013). The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound (FTA, 2006). The normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 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 (OSHA, 2013).

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

- The total sound energy radiated by a source, usually reported as a sound power level.
- The actual air pressure changes experienced at a particular location, usually measured as a sound pressure level (SPL) (the frequency characteristics and SPL combine to determine the loudness of a sound at a particular location).
- The duration of a sound.
- The changes in frequency characteristics or pressure levels through time.

Figure 8.1.13-1 presents the sound levels of typical events that occur on a daily basis in the environment. For example, conversational speech is measured at about 55 to 60 dBA, whereas a band playing loud music may be as high as 120 dBA.

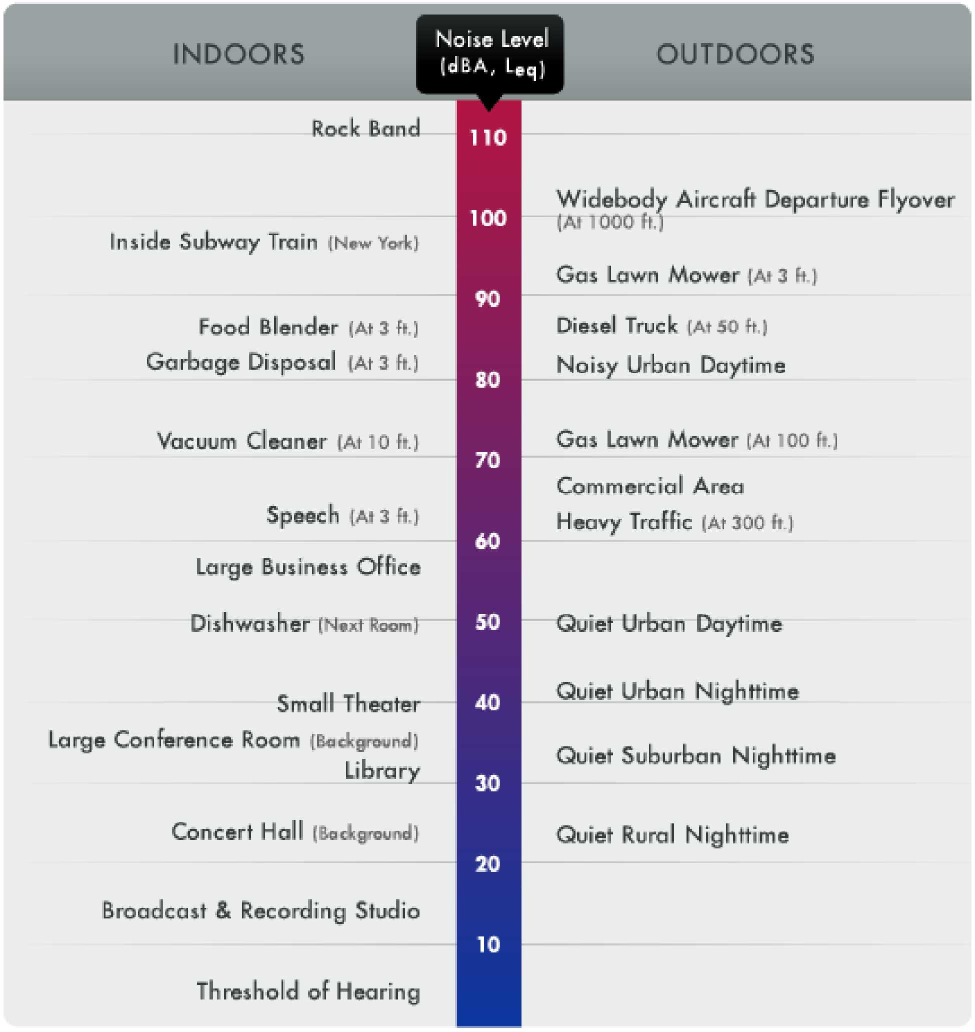


Figure 8.1.13-1: Sound Levels of Typical Sounds

Leq: Equivalent Continuous Sound Level
Source: (Sacramento County Airport System, 2015)
Prepared by: Booz Allen Hamilton

Because of the logarithmic unit of measurement, sound levels cannot be added or subtracted linearly. However, several methods of estimating sound levels can be useful in determining approximate sound levels.

First, if two sounds of the same level are added, the sound level increases by approximately three dB (for example: 60 dB + 60 dB = 63 dB). Secondly, the sum of two sounds of a different level is slightly higher than the louder level (for example: 60 dB + 70 dB = 70.4 dB).

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

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

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

8.1.13.2. Specific Regulatory Considerations

As identified in Appendix C, Environmental Laws and Regulations, the Noise Control Act of 1972, along with its subsequent amendments (e.g., Quiet Communities Act of 1978 [42 U.S.C. Parts 4901−4918]), delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Although no federal noise regulations exist, the USEPA has promulgated noise guidelines (USEPA, 1974). Similarly, most states have no quantitative noise-limit regulations.

Washington has several applicable state-wide noise regulations that could apply to various actions of the Proposed Action. Specifically, Washington has regulations that deal with maximum environmental noise levels (Chapter 93-60 Washington Administrative Code (WAC)), motor vehicle noise levels (Chapter 93-62 WAC), and sound level measurement procedures (Chapter 93-58 WAC).

Many cities and towns may have additional, local noise ordinances to further manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Large cities and towns, such as Seattle, Spokane, Tacoma, Vancouver, and Bellevue are likely to have different regulations than rural or suburban communities largely due to the population density and difference in ambient noise levels (FHWA, 2011). Table 8.1.13-1 provides an overview of Washington’s state laws relating to noise.

Table 8.1.13-1: Relevant Washington Noise Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
Chapter 93-58 WAC, Sound level measurement procedures	Washington DOE	Establishes standardized procedures for the measurement of sound levels of sources regulated by the department of ecology, including, but not limited to, environmental noise, motor racing vehicles, construction, float planes, railroads, and aircraft engine testing
Chapter 93-60 WAC, Maximum environmental noise levels	Washington DOE	Adopted rules for establishing maximum noise levels permissible in identified environments
Chapter 93-62 WAC, Motor vehicle noise performance standards	Washington DOE	Adopted noise emission standards for new motor vehicles and noise emission standards for the operation of motor vehicles on public highways

Source: (Washington Department of Ecology, 2015p)

8.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in Washington varies widely based on the area and environment of the area. The population of Washington can choose to live and interact in areas that are large cities, rural communities, and national and state parks. Figure 8.11.1-1 illustrates noise values for typical community settings and events that are representative of what the population of Washington may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Washington. As such, this section describes the areas where the population of Washington 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 the Interior, 2008). Urban areas that are likely to have the highest ambient noise levels in the state are: Seattle, Spokane, Tacoma, Vancouver, and Bellevue.
- **Airports:** Areas surrounding airports tend to be more sensitive to noise due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2007). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports are in the proximity of urban communities; therefore, aircraft operations (arrivals/departures) can result in noise exposure in the surrounding areas to be at higher levels with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In Washington, Seattle-Tacoma International Airport (SEA) and Spokane International Airport (GEG) have more than 400,000 annual operations combined (FAA, 2015j). These operations result in increased ambient noise levels in the surrounding communities. See Section 8.1.1, Public Safety Infrastructure, and Figure 8.1.1-1for 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 (USDOT, 2015b). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living in those areas. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (USDOT, 2015b). See Section 8.1.1, Public Safety Infrastructure, and Figure 8.1.1-1 for more information about the major highways in the state.
- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (FTA, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (USDOT, 2015c). Washington has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors extend from Tacoma to Portland, Oregon to the south, Vancouver to the north, and Spokane to the east. A number of other rail corridors join these major rail lines and connect with other cities (WSDOT, 2013). See Section 8.1.1, Public Safety Infrastructure, and Figure 8.1.1-1 for more information about rail corridors in the state.

- **National and State Parks:** The majority of national and date parks are likely to have lower than average ambient noise levels given their size and locations in wilderness areas. These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014f). Washington has 14 national parks and 18 National Natural Landmarks (NPS, 2014e). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 8.1.8, Visual Resources, for more information about national and state parks for Washington.

8.1.13.4. Sensitive Noise Receptors

Noise-sensitive receptors include residences, schools, medical facilities, places of worship, libraries, churches, nursing homes, concert halls, playgrounds, and parks. Sensitive noise receptors are typically areas where the intrusion of noise can disrupt the use of the environment. A quiet urban area usually has a typical noise level in the daytime of 50 dBA, and 40 dBA during the evening. Noise levels in remote wilderness and rural nighttime areas are usually 30 dBA (BLM, 2014). Most cities, towns, and villages in Washington have at least one school, church, or park, in addition to likely having other noise-sensitive receptors. There are most likely thousands of sensitive receptors in Washington.

8.1.14. Climate Change

8.1.14.1. Definition of the Resource

Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is defined as "…a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or human activity." (IPCC, 2007)

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 2012c). The IPCC is now 95 percent certain that humans are the main cause of current global warming (IPCC, 2013). Human activities result in emissions of four main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons (a group of gases containing fluorine, chlorine, or bromine) (IPCC, 2007). The common unit of measurement for GHGs is metric tons of CO_2-equivalent (MT CO_2e[146]), 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" (IPCC, 2007). "Atmospheric concentrations of CO_2 increased from 280 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (IPCC, 2007). The atmospheric concentration of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270

[146] CO_2e refers to Carbon Dioxide Equivalent, "A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as million metric tons of carbon dioxide equivalents ($MMTCO_2e$). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. $MMTCO_2e$ = (million metric tons of a gas) * (GWP of the gas)" (USEPA, 2015t)

parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (IPCC, 2007). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (IPCC, 2007).

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this PEIS (see Section 8.2, Environmental Consequences). Existing climate conditions in the project area are described first by state and sub-region, where appropriate, and then by future projected climate scenarios. The discussion focuses on the following climate change impacts: 1) temperature; 2) precipitation; 3) sea level; and 4) severe weather events (including tropical storms, tropical cyclones, and hurricanes).

8.1.14.2. Applicable Statutes and Regulations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C, Environmental Laws and Regulations. Washington has established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 8.1.14-1, these state laws/regulations are the primary policy drivers on climate change preparedness and GHG emissions.

Table 8.1.14-1: Applicable Washington Climate Change Statutes and Regulations

State Laws/Regulations	Regulatory Agency	Applicability
E2SSB 5560: State Agency Climate Leadership Act	State of Washington	In 2009, the Washington State Legislature approved the State Agency Climate Leadership Act E2SSB 5560, which established GHG emissions reduction limits for state agencies, and directed state agencies to quantify GHG emissions, report on actions taken to reduce GHG emissions, and develop a strategy to meet the GHG reduction targets.
Executive Order 09-05	State of Washington	On May 21, 2009, Gov. Gregoire directed implementation of state actions to reduce GHG emissions, increase transportation and fuel-conservation options for Washington residents, and protect our state's water supplies and vulnerable coastal areas.

8.1.14.3. Washington Greenhouse Gas Emissions

Estimates of Washington's total GHG emissions vary. The Department of Energy's (DOE) Energy Information Agency (EIA) collects and disseminates national-level emissions data on other GHGs such as methane (CH_4) and nitrous oxide (NO_x), but not at the state level (EIA, 2011). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015j). Individual states have developed their own GHG inventories, which are updated with different frequencies and trace GHGs in a variety of ways.

For the purposes of this PEIS, the EIA data on CO_2 emissions are 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 are described and cited.

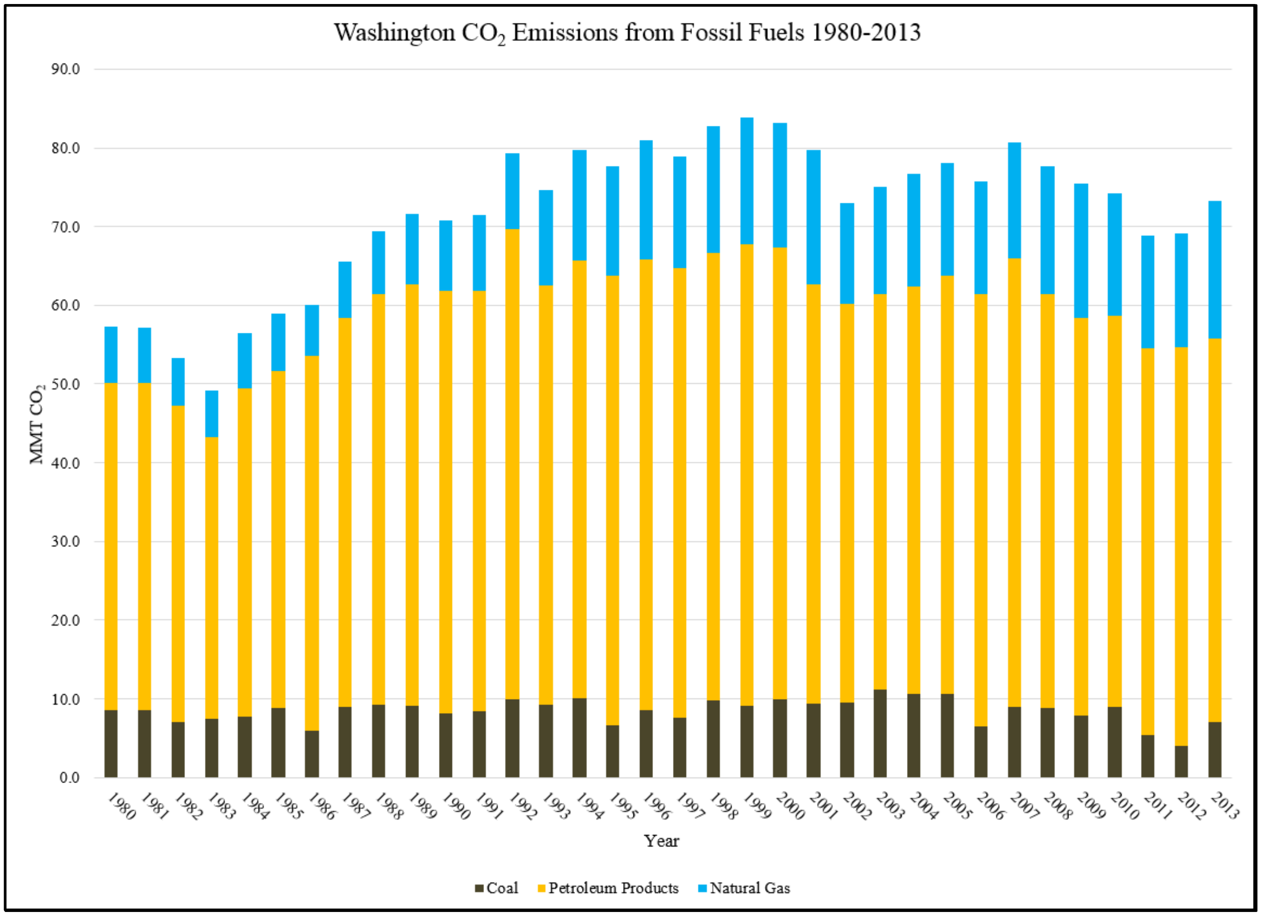
According to the EIA, Washington emitted a total of 73.1 MMT CO_2 in 2013 with the transportation sector as the largest emitter at 54 percent (Table 8.1.14-2) (EIA, 2015c). Annual emissions between 1980 and 2013 are presented in Figure 8.1.14-1 (EIA, 2015c). Between 1980 and 1983, emissions declined from 57.3 MMT to 49.3 MMT in all areas and fuels although mostly in petroleum products in the transportation sector. From 1984 to 1999 emissions increased to a maximum of 83.9 MMT due to growth in petroleum products and natural gas emissions, before falling to 73 MMT in 2002. From 2002 to 2007 emissions rose, then fell until 2012. In 2013 emissions increased by 4 MMT, due to increases in emissions from coal and natural gas. During the entire period 1980-2012, emissions from coal have remained relatively constant, although falling in 2011 and 2012. Washington does not generate a large proportion of emissions from the electric power sector as it is the largest generator of electricity from hydropower in the U.S. (EIA, 2015d). In 2013, Washington was ranked 41st for per-capita energy-related CO_2 emissions in the U.S., and was ranked 26th for total CO_2 emissions (EIA, 2015d).

Table 8.1.14-2: Washington CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2012

Fuel Type (MMT)		Source (MMT)	
Coal	7.1	Residential	5.3
Petroleum Products	48.7	Commercial	3.8
Natural Gas	17.4	Industrial	12.6
		Transportation	39.8
		Electric Power	11.7
TOTAL	**73.1**	**TOTAL**	**73.1**

Source: (EIA, 2015c)

Figure 8.1.14-1: Washington CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013



Source: (EIA, 2015c)

The majority of Washington's GHG emissions are CO_2. These emissions are the result of fossil fuel combustion for producing energy, mostly petroleum products used in the transportation sector and for home heating, and a growing proportion of natural gas for heat and hot water in residential and commercial buildings. Other major GHGs emitted in Washington are CH_4, hydrofluorocarbons, NO_x, sulfur hexafluoride (SF_6) and perfluorocarbons (EIA, 2015g).

Washington commissioned the Center for Climate Strategies to prepare a 1990 to 2020 inventory and reference case projection in 2007 (Washington Department of Ecology, 2007b). Total U.S. GHGs were 6,673 MMT (14.7 trillion pounds) in 2013. In 2012, Washington emitted 69.0 MMT CO_2. Washington has lower per-capita energy-related GHG emissions than the U.S. average. Emissions came from energy related activities across all sectors such as residential (24.3 percent) commercial (18.8 percent) industrial (27.9 percent) and transportation (29.1 percent). At 29.1 percent, the transportation sector contributed the majority of GHG emissions in Washington in 2013 (EIA, 2015g).

Washington's emissions account for about 1 percent of the nation's gross emissions. Residents emit about 15 metric tons, which is low compared to the U.S. average (25 Mt CO_2e). This is likely from the state's use of hydroelectricity. Gross emissions within the state have grown and will likely continue to grow to past 2020 (Washington Department of Ecology, 2007b). State level emissions increased between 1990 and 2000, followed by a decline in 2000. This improvement is a result of hydroelectric generation and new wind plants, which is now the state's largest resource for electricity generation. Washington is the nation's leading producer of hydroelectric power in fact, a majority of the state's 10 power plant are hydroelectric facilities located along the Columbia River. Remaining electricity is generated from natural gas-fired power plants, a nuclear power plant, biomass, wind, and two coal fired power plant (Washington Department of Ecology, 2007b).

State industrial emissions declined between 1990 and 1999, followed by a large growth as a result of the use of chlorofluorocarbons and hydrochlorofluorocarbons. These emissions are expected to double by 2020. Washington's biggest industries are forest and transportation equipment manufacturing, which are large emissions contributors. Transportation is also a large GHG gas contributor. However, the state consumes the same amount of gasoline per capital while diesel fuel consumption is lower than the U.S. average. Transportation emissions will continue to be the largest contributors by the year 2020 (Washington Department of Ecology, 2007b).

Washington is not a natural gas or petroleum producer however, there are three crude oil refineries that refine oxygenated motor gasoline, jet fuel, and conventional motor gasoline. Approximately one third of residents use natural gas for their main source of heating; resources enter the state from Canada and other nearby states. Emissions from the residential and commercial sectors will likely increase to 11 MMT CO_2e by 2020 (Washington Department of Ecology, 2007b).

Washington is taking steps towards decreasing state emissions by decommissioning coal-fired power plants. The last coal mine closed in 2006, which has contributed to the reduction in emissions attributed to fueling coal-fired power plants. Coal now enters the state to supply the remaining coal-fired power plants via rail from surrounding states (Washington Department of Ecology, 2007b).

8.1.14.4. Environmental Setting: Existing Climate

The National Weather Service defines climate as the "reoccurring average weather found in any particular place" (NWS, 2011a). The widely accepted division of the world into major climate categories is referred to as the Köppen-Geiger climate classification system. Climates within this system are classified based "upon general temperature profiles related to latitude" (NWS, 2011a). The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly temperature characteristics (NWS, 2011b).

The majority of Washington falls into climate group (C). Climates classified as (C) are warm, with humid summers and mild winters. During winter months, "the main weather feature is the mid-latitude cyclone" (NWS, 2011a). During summer months, thunderstorms are frequent. Areas of northern, north central, and northeastern Washington fall into climate group (D).

Climates classified as (D) are "moist continental mid-latitudinal climates," with "warm to cool summers and cold winters" (NWS, 2011a). In (D) climates, the "average temperature of the warmest month is greater than 50 °F, while the coldest month is less than negative 22 °F" (NWS, 2011a). Winter months in (D) climate zones are cold and severe with "snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NWS, 2011a) (NWS, 2011b). Lastly, areas of central and southern Washington fall into climate group (B). Climates classified as (B) are dry climates, "in large continental regions of the mid-latitudes often surrounded by mountains" (NWS, 2011a). "The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation" (NWS, 2011a).

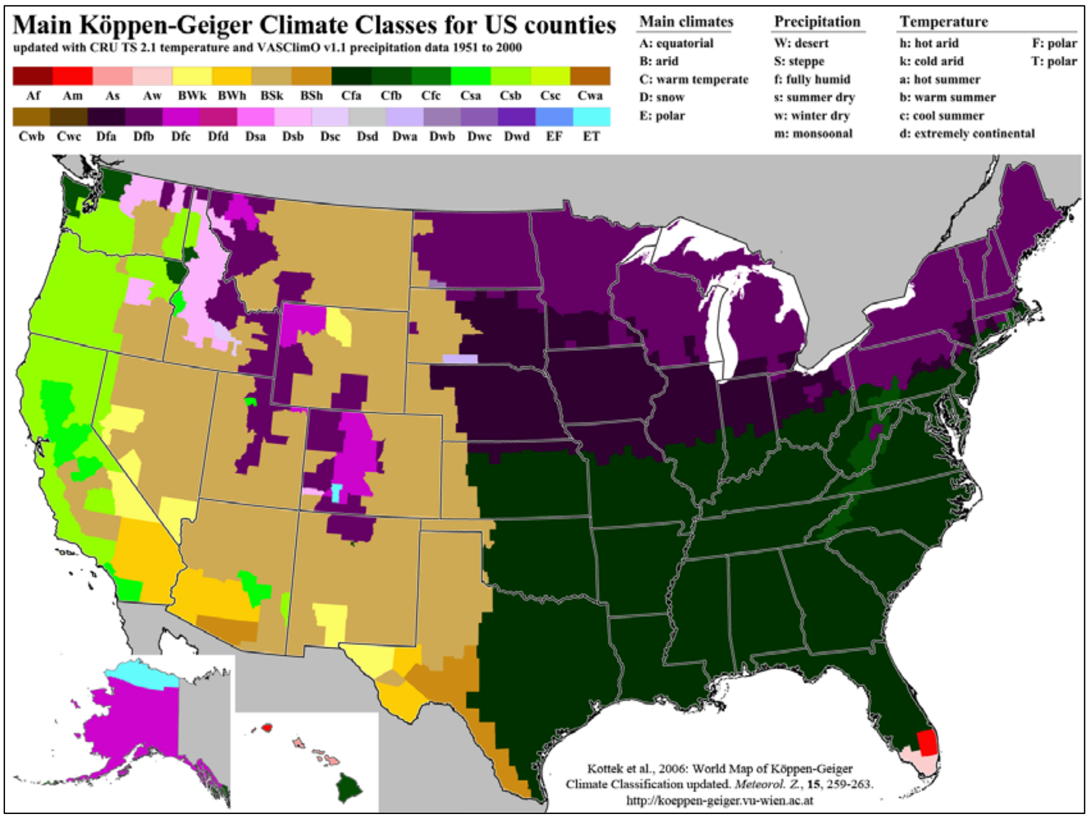


Figure 8.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, 2006)

Bsk – The Köppen-Geiger climate classification system classifies areas of central and southern Washington as Bsk. Climates classified as Bsk, are mid-latitude and dry. "Evaporation exceeds precipitation on average but is less than potential evaporation" (NWS, 2011b). Average temperatures in Bsk climate zones are less than 64 °F. (NWS, 2011a) (NWS, 2011b)

Cfa – The Köppen-Geiger climate classification system classifies areas of northwestern Washington as Cfa. Cfa climates are generally warm, with humid summers and mild winters. In this climate classification zone, the secondary classification indicates year-round rainfall, but it is highly variable; thunderstorms are dominant during summer months. In this climate classification zone, the tertiary classification indicates mild, hot summers with average temperatures of warm months over 72 °F. Average temperatures of the coldest months are under 64 °F. (NWS, 2011a) (NWS, 2011b)

Csb – The Köppen-Geiger climate classification system classifies a large area of southern, central, and western Washington as Csb. Csb climates are Mediterranean, with mild temperatures and cool, dry summers. In Csb climates, the coldest months are warmer than 26 °F but cooler than 64 °F, with at least four months averaging temperatures greater than 50 °F (GLOBE SCRC, 2015) (NWS, 2011b). Summers in Csb climates are dry and mild (GLOBE SCRC, 2015). Winters in Csb climates typically have high levels of frost, with "at least three times as much precipitation during [the] wettest winter months as in the driest summer month" (NWS, 2011b). Csb climates are typically found on western sides of continents and near the coast (GLOBE SCRC, 2015) (NWS, 2011a) (NWS, 2011b)

Dfb – The Köppen-Geiger climate classification system classifies a small area of northern and northeastern Washington as Dfa. Climates classified as Dfa are characterized by warm and humid temperatures, with hot summers and precipitation occurring regularly throughout the year. In this climate classification zone, the secondary classification indicates substantial precipitation during all seasons. In this climate classification zone, the tertiary classification indicates hot summer months, with warmer temperatures averaging above 71.6 °F. (NWS, 2011a) (NWS, 2011b)

Dsb – The Köppen-Geiger climate classification system classifies a small region of northern and northeastern Washington as Dsb. Climates classified as Dsb experience dry conditions, with warm summers, and ample snow. Dsb climates experience at least one month that is colder than 26 °F. This climate is generally found in high elevations. (GLOBE SCRC, 2015) (NWS, 2011a) (NWS, 2011b)

This section discusses the current state of Washington's climate with regard to air temperature, precipitation, sea level, and extreme weather events (e.g., drought, heat waves, extreme rain or snow, and flooding) in the state's five climate regions, Bsk, Cfa, Csb, Dfb, and Dsb.

Air Temperature

The Cascade Mountains, Puget Sound, and Pacific Ocean all play significant roles in modifying Washington's climate. For example, while cold air masses are most common in eastern Washington, "allowing the temperature to be low enough for snow in the winter, the Puget Sound keeps the air temperature relatively warm for the lowland locations west of the Cascades, keeping more of the winter snow-free" (Bumbaco, 2015).

The greatest temperature to occur in Washington was on July 24, 1928 and August 5, 1961 with a record high of 118 °F at Wahluke and Ice Harbor Dam respectively (Office of the Washington State Climatologist, 2015). The lowest temperature to occur in Washington was on December 30, 1968 with a record low of negative 48 °F in Winthrop (Office of the Washington State Climatologist, 2015). Between 1900 and 2014, the warmest year statewide occurred in 1934, with an average of 50.9 °F. In 2015, the average temperature statewide surpassed that of 1934, however, the official average temperature value has not yet been officially determined. The coldest year statewide occurred in 1955, with an average of 44.8 °F. Vancouver typically experiences the warmest average annual temperatures of the state, with an average of 54.1 °F. (Office of the Washington State Climatologist, 2015)

The following paragraphs describe annual temperatures as they occur in the various climate classification zones:

Bsk – Kennewick, located in southeastern Washington, is within the climate classification zone Bsk. The average annual temperature in Kennewick is approximately 54.7 °F; 36.3 °F during winter months; 73.3 °F during summer months; 54.6 °F during spring months; and 54.3 °F during autumn months (NOAA, 2015l).

Cfa – Seattle, located in northwestern Washington, is within the climate classification zone Cfa. The average annual temperature in Seattle is approximately 52.6 °F; 42.0 °F during winter months; 64.3 °F during summer months; 51.0 °F during spring months; and 53.2 °F during autumn months (NOAA, 2015l).

Csb – Spokane, located in eastern Washington, is within the climate classification zone Csb. The average annual temperature in Spokane is approximately 46.1 °F; 28.1 °F during winter months; 64.3 °F during summer months; 46.0 °F during spring months; and 45.7 °F during autumn months (NOAA, 2015l).

Dfb – Colville, located in northeastern Washington, is within the climate classification zone Dfb. The average annual temperature in Colville is approximately 49.2 °F; 30.1 °F during winter months; 68.0 °F during summer months; 49.6 °F during spring months; and 48.7 °F during autumn months (NOAA, 2015l).

Dsb – Winthrop, located in northern Washington, is within the climate classification zone Dsb. The average annual temperature in Winthrop is approximately 46.0 °F; 24.3 °F during winter months; 65.9 °F during summer months; 47.1 °F during spring months; and 46.4 °F during autumn months (NOAA, 2015l).

Precipitation

Statewide, Washington experiences an average annual precipitation accumulation of 38.44 inches. However, due to the north-south orientation of the Cascade Mountain range, average annual precipitation values throughout the state are highly variable, as well as dependent on location in relation to the mountain range. For example, areas located east of the mountain range are relatively dry. Yakima is east of the mountain range experiences an annual average of approximately 8.26 inches of precipitation. Spokane, also east of the mountain range, experiences an annual average of approximately 16.67 inches of precipitation.

West of the Cascade, precipitation events are much more common than in the east. Seattle, for example, located west of the Cascades experiences an annual average of 37.07 inches of precipitation. Rainfall in Seattle is also unique, with storms typically classified as light to moderate and lasting over a long period. By comparison, shorter, heavy rainfall is more common along the Atlantic Ocean and in east coast cities. As a result, "days with measureable rain during the winter, 20 – 25 days or more in a month is not uncommon" in Washington (Bumbaco, 2015).

Washington’s wettest precipitation station is Forks, located on the Olympic Peninsula, with an annual average precipitation of 121.73 inches (Bumbaco, 2015). Rainfall throughout the Olympic Peninsula is so significant, that there is even a rainforest. Hoquiam and Quillayute also receive substantial amounts of rainfall annually, with averages of 68.69 inches and 101.72 inches respectively. The state’s driest precipitation station is Priest Rapids Dam, located in south central Washington, with an annual average of 6.84 inches (Bumbaco, 2015).

The greatest 24-hour precipitation accumulation to occur was on November 23, 1986 with a total of 14.26 inches at Mt. Mitchell (Office of the Washington State Climatologist, 2015). The greatest 24-hour snowfall accumulation to occur was on February 24, 1994 with a total of 65 inches at Crystal Mountain (Office of the Washington State Climatologist, 2015). The greatest total snowfall accumulation during a single year occurred in 1998-1999 with a U.S. record of 95 feet or 1,140 inches at Mt. Baker (Office of the Washington State Climatologist, 2015).

The following paragraphs describe annual precipitation as it occurs in the various climate classification zones:

Bsk – Kennewick, in southeastern Washington, is within the climate classification zone Bsk. The average annual precipitation accumulation in Kennewick is approximately 7.73 inches; 2.99 inches during winter months; 0.91 inches during summer months; 1.93 inches during spring months; and 1.90 inches during autumn months (NOAA, 2015l).

Cfa – Seattle, in northwestern Washington, is within the climate classification zone Cfa. The average annual precipitation accumulation in Seattle is approximately 37.49 inches; 14.42 inches during winter months; 3.15 inches during summer months; 8.37 inches during spring months; and 11.55 inches during autumn months (NOAA, 2015l).

Csb – Spokane, in eastern Washington, is within the climate classification zone Csb. The average annual precipitation accumulation in Spokane is approximately 17.08 inches; 5.86 inches during winter months; 2.39 inches during summer months; 4.70 inches during spring months; and 4.13 inches during autumn months (NOAA, 2015l).

Dfb – Colville, located in northeastern Washington, is within the climate classification zone Dfb. The average annual precipitation accumulation in Colville is approximately 19.84 inches; 5.98 inches during winter months; 4.03 inches during summer months; 5.30 inches during spring months; and 4.53 inches during autumn months (NOAA, 2015l).

Dsb – Winthrop, located in northern Washington, is within the climate classification zone Dsb. The average annual precipitation accumulation in Winthrop is approximately 14.75 inches; 5.78 inches during winter months; 2.47 inches during summer months; 2.91 inches during spring months; and 3.59 inches during autumn months (NOAA, 2015l).

Sea Level

The state of Washington has approximately 157 miles of coastline and 3,026 miles of tidal coastline (U.S. Department of Commerce, 2015). Since 1900, “global sea level has risen approximately seven inches and is anticipated to rise an additional 24 inches over the next century along the Washington coast” (Washington Department of Ecology, 2012b). Unlike along the east coast of the U.S., sea level rise along the west coast is largely influenced by climate patterns such as El Niño-Southern Oscillation and Pacific Decadal Oscillation. These climate patterns affect winds and ocean circulation, "raising sea level during warm phases (e.g., El Niño) and lowering sea level during cool phases (e.g., La Niña). During large El Niño events, sea level along the coast can rise by as much as 10 to 30 centimeters. (The National Academies Press, 2012)

Severe Weather Events

Washington state is "among the nation's leaders in presidentially declared weather-related disasters" (NWS, 2015a). Severe weather most common to Washington includes drought, landslides, windstorms, extreme rain or snow, and flooding. Since 1971, multiple droughts throughout the state have resulted in "dry streams, withered and abandoned crops, dead fish, record low rivers, and declining groundwater levels." The worst drought to occur in the history of the Pacific Northwest was during 1976 and 1977. During this time, crop yields were significantly below normal, there were "region wide water rationing and power consumption restrictions," and significant economic impacts (NWS, 2015a). Between 2000 and 2005, the state also experienced "two drought emergencies, resulting in drought declarations by Governors Locke Gregoire" (Washington Department of Ecology, 2015q).

Landslides in Washington are also relatively common as compared to other states in the U.S., as rain-soaked soils "are prone to slipping, which results in landslides affecting homes, businesses, power lines, and transportation routes" (Washington Department of Ecology, 2015q). During one of Washington's most severe landslides, "five years of above average winter rainfall contributed to a massive slide in the Hunter Point, Carlyon Beach area of Thurston County in February 1999" (Washington Department of Ecology, 2015q). In total, this landslide "stretched 3,000 feet along the Squaxin Passage shoreline and extended inland 900 feet" (Washington Department of Ecology, 2015q). The steepest slopes of the landslide reached 15 feet. As a result, the landslide damaged 41 homes, 33 of these homes were declared uninhabitable, and homeowners were requested to evacuate due to severe structural damage. The total estimated cost of repairs for these damaged structures was between $4 and $39 million. Furthermore, homes in the Carlyon Beach area that were once valued at approximately $200,000 dropped to $1,000. "Ninety other properties in the Hunter Point, Carlyon Beach area dropped in value to almost nothing" (Washington Department of Ecology, 2015q).

Due to its location along the Pacific Ocean, Washington is not susceptible to hurricanes. However, in place of hurricanes, the state commonly experiences strong and damaging winds as a result of Pacific low pressure systems. In some cases, wind speeds can reach up to 60 miles per hour (mph) and can cause power outages and property damages. "About once every decade, storms with powerful winds of 70 mph or more pound the region, producing significant property damage" (Washington Military Department of Emergency Management Division, 2015). On October 12, 1962 the "strongest non-tropical windstorm ever to hit the lower 48 states in recorded American history struck the Pacific Coast. The storm claimed 46 lives, injured hundreds more, and knocked power out for several million people" (Washington Military Department of Emergency Management Division, 2015). In total, this storm caused over $235 million in property damages and approximately $750 million in damages to the timber industry. This storm was the most destructive windstorm to occur in Washington since 1900. (NWS, 2015a)

Between January and February of 1916, Seattle experienced record snowfall and the greatest 24-hour snowfall accumulation in the city's history, with a total of 21.5 inches on February 1, 1916. Other regions of the state received between two and four feet of snow and strong winds created snow drifts that reached five feet in height. As a result, the city was essentially crippled, as all transportation was halted. Washington is also home to the nation's deadliest avalanche, which occurred on March 1, 1910 along Steven's Pass. This devastating storm claimed 96 lives after sweeping two trains into a ravine. (NWS, 2015a)

Washington's most destructive and deadliest blizzard to occur was on January 13, 1950 when a total of 21.4 inches of snow fell over Seattle during a 24-hour period (the second greatest 24-hour snowfall accumulation record); couple with winds ranging between 25 and 40 mph. As a result, 13 people were killed in the Puget Sound area. This period of 1949 to 1950 is also the coldest winter on record for Washington, with an average of 34.4 °F. (NWS, 2015a)

Washington's deadliest tornado outbreak occurred on April 5, 1972 when an F3 tornado touched down in Vancouver. In total, six people were killed and 300 were injured. Washington State led the country in tornado-related deaths this year. Concerning monetary damages, the state estimated a loss of approximately $50 million. Washington State is also susceptible to volcanic eruptions and is home to one of the nation's most active volcanoes, Mount St. Helens. On May 18, 1980, an eruption killed over 60 people and caused a massive mud flow along the Toutle River. In addition, the volcanic eruption caused an ash storm, in which ash fell like snow, causing drifts as deep as two feet high. This ash storm crushed crops, halted transportation, and caused many schools and businesses to close. (NWS, 2015a)

Flooding is also common to Washington, with the most common forms of flooding being flash flooding, riverine flooding, coastal flooding, ice/debris jams, snowmelt, dry wash, and dam breaks/levee failures. In November 1990, statewide flooding occurred due to excessive rainfall and snowmelt along many rivers in western, northwest, and eastern Washington. As a result, two people were killed and damages totaled approximately $250 million. In addition, this flood "stands as the highest flood of record for many northwest Washington rivers including the Elwha, Cedar, Snoqualmie, Skokomish, Snohomish, and Stillaguamish. Severe and record flooding also occurred in February 1996 throughout Washington, Oregon, and Idaho, originating along the rivers in western and southeast Washington. In total, damages from this flood amounted to $800 million and three people were killed in Washington. (NWS, 2015a)

8.1.15. Human Health and Safety

8.1.15.1. Definition of the Resource

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

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

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation or vehicle traffic. Vehicle traffic is evaluated in Section 8.1.1, Infrastructure.

8.1.15.2. Specific Regulatory Considerations

Federal organizations, such as the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In Washington, the Washington Department of Labor and Industries (WDL&I), Division of Occupational Safety and Health (WDOSH), and the Washington DOE regulate this resource area. Federal OSH regulations apply to workers through either OSHA, or stricter state-specific plans that must be approved by OSHA. Washington has an OSHA-approved “State Plan,” which covers private, and state and local government workplaces. WDOSH has unique regulations for heat exposure, noise exposure, toxic chemical handling and exposure, agriculture, and child labor (OSHA, 2015a). OSHA enforces occupational safety and health regulations at the federal level. The Washington DOH regulates public health.

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders next to the text referring to Appendix C. Table 8.1.15-1 below summarizes the major Washington laws relevant to the state’s occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 8.1.15-1: Relevant Washington Human Health and Safety Laws and Regulations

State Law and Regulation	Regulatory Agency	Applicability
Revised Code of Washington: Title 49, Chapter 49.17	Washington Department of Labor and Industries (WDL&I)	Establishes the Washington Industrial Safety and Health Act, which requires workplace industrial safety and health programs to ensure safe working conditions.
WAC: Title 173, Chapter 93-340	Washington DOE	Establishes the Model Toxics Control Act that outlines requirements for site hazard assessments and hazard ranking system for contaminated sites.
WAC: Title 296, Chapter 296-32	WDL&I	Outlines requirements for telecommunications workers, including regulations for work with overhead lines, underground lines and cable vaults, buried facilities, and lift equipment.

State Law and Regulation	Regulatory Agency	Applicability
Washington Administrative Code (WAC): Title 296, Chapter 296-62	WDL&I	Establishes requirements to control occupational health hazards and requires chemical hazard communications programs to protect against carcinogens, air pollutants, biological and physical agents (e.g., asbestos, lead, and electrical hazards) in accordance with the Washington Industrial Safety and Health Act.
WAC: Title 296, Chapter 296-62-095	WDL&I	Establishes Outdoor Heat Exposure Rule for employees working outdoors between May 1 and September 30. Requirements include heat exposure safety programs, drinking water availability, and response plan for heat-related illness.
WAC: Title 296, Chapter 296-155	WDL&I	Consolidates occupational health and safety requirements for work places subject to the Washington Industrial Safety and Health Act where construction, alteration, demolition, related inspection, and /or maintenance and repair work is performed. Establishes safety requirements for hazard communications, fall protection, electrical safety, noise exposure, trenching, and steel erection.

8.1.15.3. Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over water bodies, and on communication towers. Tasks may also be performed at dangerous heights or in confined spaces, while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring (OSHA, 2016a). A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

Working from height, overhead work, and slips, trips, or falls – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights up to 2,000 feet above the ground's surface (OSHA, 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 public who may be observing the work or transiting the area (International Finance Corporation, 2007).

Trenches and confined spaces – Installation of underground utilities, building foundations, and work in utility manholes[147] are examples of when confined space work is necessary. Installation of telecommunication activities involves laying conduit 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

[147] 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.

movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics. (OSHA, 2016b)

Heavy equipment and machinery – New and replacement facility deployment and maintenance can involve the use of heavy equipment and machinery. During the lifecycle of a telecommunication site, heavy equipment such as bulldozers, backhoes, dump trucks, cement trucks, and cranes are used to prepare the ground, transport materials, and soil, and raise large sections of towers and antennas. Telecommunication workers may be exposed to the additional site traffic and often work near heavy equipment to direct the equipment drivers and to accomplish work objectives. Accessory machinery such as motorized pulley systems, hydraulic metal shears, and air driven tools present additional health and safety risks as telecommunication work sites. These pieces of machinery can potentially sever skin and bone, or cause other significant musculoskeletal injuries to the operator. (OSHA, 2016b)

Energized equipment and existing utilities – Electrical shock from energized equipment and utilities is an elevated risk at telecommunication sites due to the amount of electrical energy required for powering communication equipment and broadcasting towers. Telecommunication cables are often co-located with underground and overhead utilities, which can further increase occupational risk during earth-breaking and aerial work (International Finance Corporation, 2007).

Optical fiber safety – Optical fiber cable installation and repair presents additional risks to telecommunications workers, including potential eye or tissue damage, through ingestion, inhalation, or other contact with glass fiber shards. The shards are generated during termination and splicing activities, and can penetrate exposed skin (International Finance Corporation, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation presents risk of fire or explosion (Fiber Optic Association, 2010).

Noise – Sources of excess noise at telecommunication sites include heavy equipment operation, electrical power generators and other small engine equipment, air compressors, electrical and pneumatic power tools, and road vehicles, such a diesel engine work trucks. The cumulative noise environment has the potential to exceed the OSHA acceptable level of 85 dB per 8-hour time weighted average (see Section 8.1.13, Noise) (OSHA, 2002). Fugitive noise may emanate beyond the telecommunication work site and impact the public living in the vicinity, observing the work, or transiting through the area. (OSHA, 2016b)

Hazardous materials and hazardous waste – Work at telecommunication sites may require the storage and use of hazardous materials such as fuel sources for backup power generators and compressed gases used for welding and metal cutting (new towers only). In some cases, telecommunication sites require use of potentially hazardous products (e.g., herbicides). Secondary hazardous materials (e.g., exhaust fumes) may be a greater health risk than the primary hazardous material (e.g., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. While it is unlikely that any FirstNet activities would involve the generation or storage of hazardous waste, older existing telecommunication structures and sites could have hazardous materials present, such as lead-based paint (exterior and interior) on outdoor structures or asbestos tiles and insulation in equipment sheds. The public, unless a telecommunication work site allows unrestricted access, are typically shielded from hazardous materials and hazardous wastes that are components of telecommunication site work. (OSHA, 2016b)

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

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

Telecommunication Worker Occupational Health and Safety

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

As of May 2015, there were 4,740 telecommunication equipment installers and repairers, and 1,320 telecommunication line installers and repairers (Figure 8.1.15-1) working in Washington (BLS, 2016b). In 2014, the most recent year data are available, Washington had 1.8 cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2013a). By comparison, there were 1.9 nonfatal occupational injury cases nationwide in both 2012 and 2013 per 100 full-time workers in the telecommunications industry (BLS, 2013b).

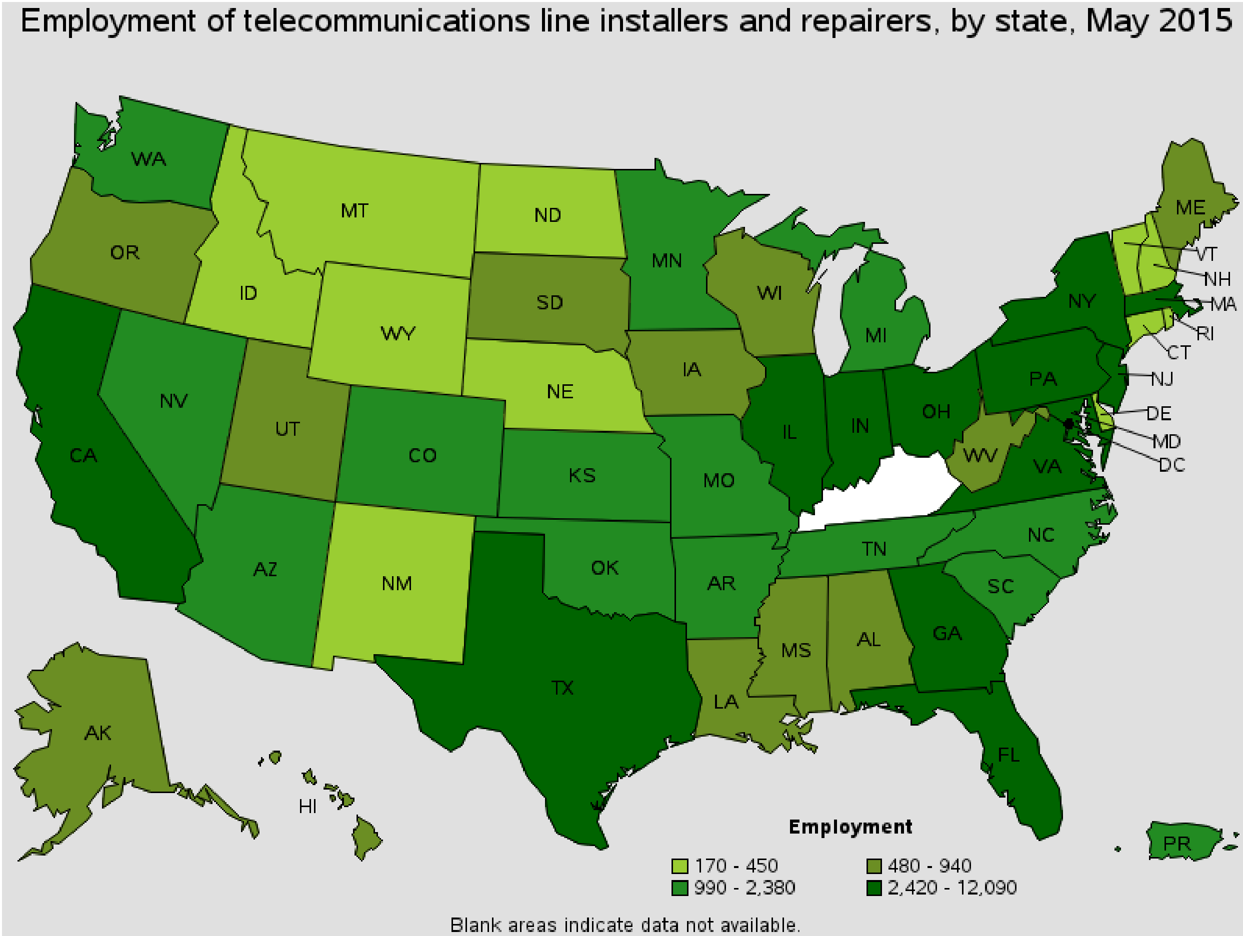


Figure 8.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015c)

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; 7 due to slips, trips, or falls; and 3 due to unknown causes), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2013c). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of occupational fatalities (4,585 total). Washington has not had any fatalities within the telecommunications industry or telecommunications occupations since 2003, when data are first available. By comparison, within the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 76 fatalities in Washington between 2003 and 2014, with the highest fatality year being 2007, with 13 fatalities (BLS, 2015d).

Public Health and Safety

The public is unlikely to encounter occupational hazards at telecommunication sites due to limited access. Environmental and public health data and statistical reports for Washington are available through the Washington DOH website (DOH, 2015f). The same data are reported with more specificity at the federal level through the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (WONDER). While the WONDER database cannot be searched for cases specific to telecommunication sites, many available injury categories are consistent with risks present at telecommunication sites. For example, in Washington, between 1999 and 2013, there were 192 fatalities due to a fall from, out of, or through a building or structure; 36 fatalities due to being caught, crushed, jammed or pinched in or between objects; and 32 fatalities due to exposure to electric transmission lines (Centers for Disease Control and Prevention, 2015a). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

8.1.15.4. 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 telecommunication site occupants, including practices before current environmental laws, could result in environmental contamination, affecting the quality of soil, sediments, groundwater, surface water, and air.

Federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[148] or listed on the National Priorities List (NPL), as well as the Resource Conservation and Recovery Act (RCRA) corrective action sites and brownfields typically classify contaminated property. 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.

Washington's Toxic Cleanup Program administers the Superfund Program, and is managed under Ecology (Washington Department of Ecology, 2015r). As of December 2015, Washington had 56 RCRA Corrective Action sites,[149] 212 brownfield sites, and 50 proposed or final Superfund/NPL sites (USEPA, 2015k). Based on a December 2015 search of USEPA's Cleanups in My Community (CIMC) database, there are eight Superfund sites (three in Seattle, WA; two in Tacoma, WA; one in Bremerton, WA; one in Renton, WA, and one in Wellpinit, WA) (USEPA, 2015l) and two RCRA Corrective Action sites (Boeing Commercial Airplane Group – Plant 2 and Container Properties, both in Seattle, WA) (USEPA, 2015l) in Washington

[148] 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).

[149] Data gathered using USEPA's CIMC search on December 15, 2015, for all sites in Washington, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (USEPA, 2013e) .

where contamination has been detected at an unsafe level, or a reasonable human exposure risk still exists.

Brownfield sites in Washington may be enrolled in a variety of programs administered by the WDOY Toxics Cleanup Program, including technical assistance, grants, and a Brownfields Revolving Loan Fund (Washington Department of Ecology, 2015s). One example of a state brownfield site is the Kendall Yards in Spokane, WA. The 77-acre site was used as a locomotive repair and refueling site, followed by a dumping ground after sitting vacant for 50 years. In 2005, Ecology and a private developer began removing 223,000 tons of soil contaminated with polycyclic aromatic hydrocarbons, petroleum byproducts, and heavy metals, using $3.4M in revolving brownfield grants awarded by the Washington Department of Community, Trade, and Economic Development. Cleanup was completed one year later, and the site was redeveloped into a mixed-use space including residential units, restaurants, shops, and commercial space. (USEPA, 2006).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). As of October 2015, Washington had 324 TRI reporting facilities. The identification of a TRI facility does not necessarily indicate that the facility is actively releasing to the environment; the majority of TRI reports involve permitted disposal facilities. According to the USEPA, in 2013, the most recent data available, Washington released 20.3 million pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from paper and metal mining industries. This accounted for 0.50 percent of nationwide TRI releases, ranking Washington 42 of 56 U.S. states and territories based on total releases per square mile. (USEPA, 2015m)

Another USEPA program is NPDES, which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment. As of November 2, 2015, Washington had 79 permitted major discharge facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015n).

The National Institutes of Health, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (NIH, 2015a). Figure 8.1.15-2 provides an overview of potentially hazardous sites in Washington.

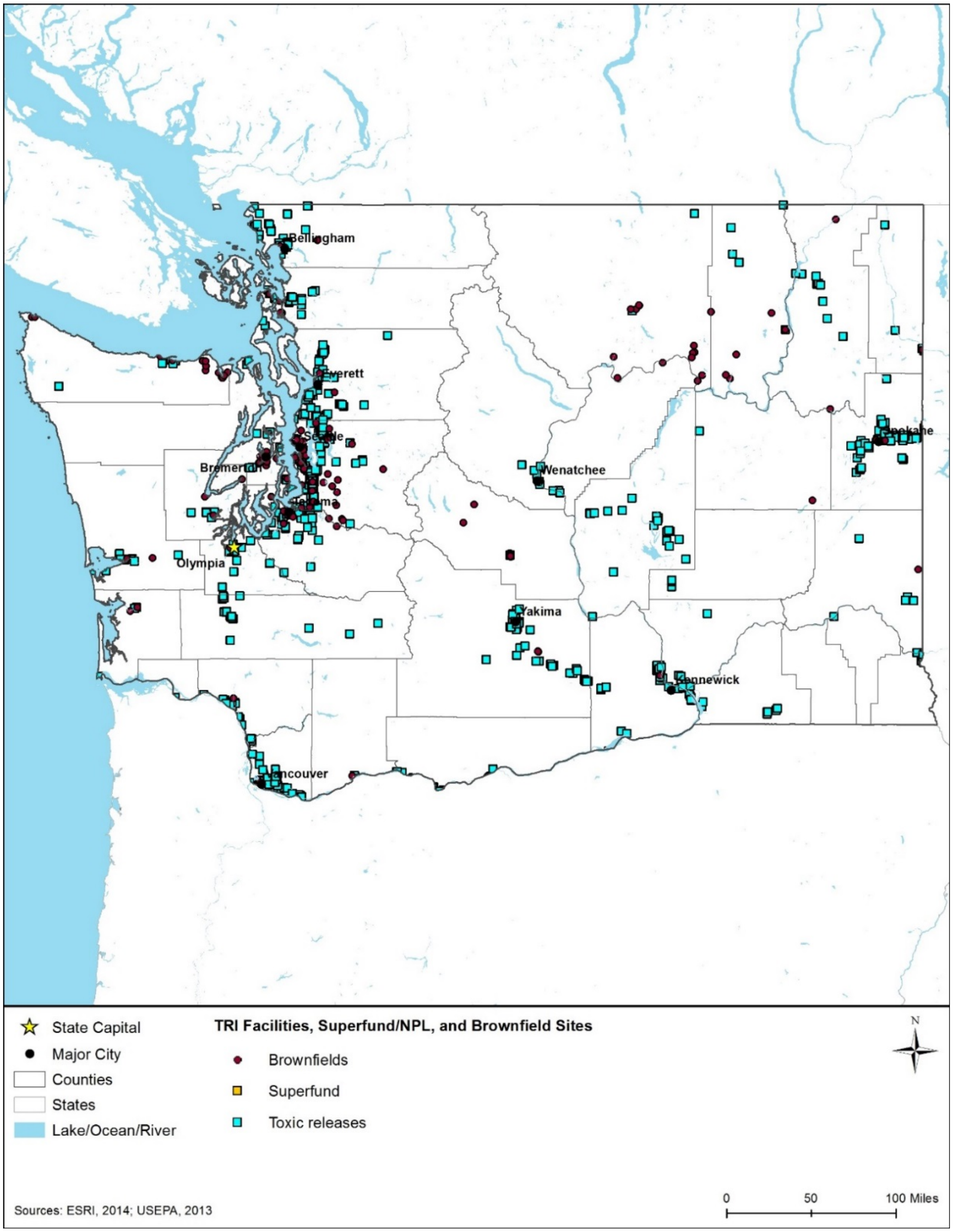


Figure 8.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Washington (2013)

Source: (NIH, 2015b)

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over water bodies. Indoor air quality may also be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. As of October 2015, there are 348 USEPA-regulated telecommunications sites in Washington (USEPA, 2015o). These sites are regulated under one or more environmental programs including NPDES compliance, Superfund/NPL status, and TRI releases.

According to BLS data, Washington has not had any fatalities from exposure to "harmful substances or environments" within the telecommunications industry or telecommunications occupations since 2003, when data are first available (BLS, 2015d). By comparison, the BLS reported three fatalities in 2011 and three " fatalities in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments" (BLS, 2015e). In 2014, BLS also reported four "fatalities within the telecommunications line installers and repairers occupation (SOC code 49-9052), and no fatalities within the telecommunications equipment installers and repairers occupation (SOC code 49-2022) due to exposure to harmful substances or environments" (BLS, 2014).

Public Health and Safety

As described earlier, access to telecommunications sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunications sites present an inherent low risk to non-occupational workers, the 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.

WDOH partners with the federal Agency for Toxic Substances and Disease Registry as part of the Site Assessments Program to provide health assessments and consultations that identify and assess human health issues at contaminated sites. Public health assessments, consultations, and advisories for documented hazardous waste sites are publicly available through the WDOH Site Assessments Program, Health Consultations website (DOH, 2015e). At the federal level, the Centers for Disease Control and Prevention, National Environmental Public Health Tracking Network, provides health, exposure, and hazard information, including known chemical contaminants, chronic diseases, and conditions based on geography. In 2009, the most recent data available, Washington reported a rate of zero injuries and fatalities due to reported acute toxic substance release incidents per 100,000 population (Centers for Disease Control and Prevention, 2015b).

Spotlight on Washington Superfund Sites: Commencement Bay

In 1983, USEPA added the Commencement Bay Nearshore/Tide Flats and South Tacoma Channel sites to the NPL. The sites are in southern Puget Sound and include the entire town of Ruston, WA, and the northern edge of Tacoma, WA. The Nearshore/Tide Flats site is 12 square miles (7,680 acres) and is currently used as a commercial seaport. Historically, the site was used for shipbuilding, oil refining, and chemical manufacturing since the 1800s, and includes the Asarco copper smelter that operated from 1888 to 1985. (USEPA, 2015p)

The South Tacoma Channel site is 2.5 square miles (1,600 acres) and includes three areas: South Tacoma Field (260 acres), Tacoma Landfill (210 acres), and Well 12A (one of 13 public drinking water wells for Tacoma, WA). South Tacoma Field was used from 1892 until 1974 by Burlington Northern Railroad for rail car manufacturing and maintenance, supported by an iron and brass foundry that produced rail car parts. Well 12A is critical in meeting peak or emergency water demands, but was taken offline in 1981 after the USEPA discovered contamination. (USEPA, 2015q)

Contaminants of concern at the Nearshore/Tide Flats site include arsenic, lead, and other heavy metals (primarily from the smelter), which spread via air pollution and settled on surface soils over 1,000 square miles. The South Tacoma Channel site also includes hazardous chemicals and heavy metals contamination from past industrial operations. Current health and safety risks at both sites include ingesting or touching contaminated soil, sediment, groundwater, or surface water. In 2009, the State of Washington received a $94.6M settlement from Asarco (Washington Department of Ecology, 2015j) and is redeveloping the site into “Point Ruston,” a multi-use space including residences, restaurants, a theater, and public art projects (USEPA, 2015p).

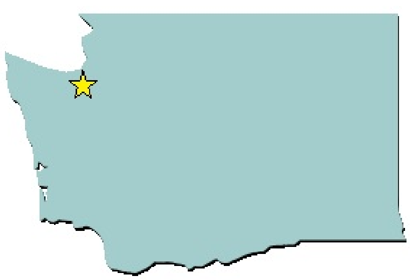


Figure 8.1.15-3: Aerial Photo of Asarco Smelter and Industrial Facilities along Commencement Bay, Tacoma, WA

Source: (Washington Department of Ecology, 2015j)

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

Another health and safety hazard in Washington includes surface and subterranean mines. In 2015, the Washington mining industry ranked 27th for non-fuel minerals (primarily sand and gravel, crushed stone, gold, portland cement, and zinc), generating a value of $936M (USGS, 2014e) (USGS, 2016c). Other minerals historically mined include silver, mercury, copper, zinc, and uranium (U.S. Department of the Interior, Bureau of Land Management, 2015a). Washington does not currently have any active coalmines as operations ceased in 2006 (Washington State Department of Natural Resources, 2015i). Health and safety hazards at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (U.S. Department of the Interior, Bureau of Land Management, 2015b).

The Washington State Department Natural Resources administers the Abandoned Mine Land Program, and is responsible for managing AML health and safety hazards at 69 known AML sites (2 on the NPL), primarily in the northern and northeastern portions of the state (U.S. Department of the Interior, Bureau of Land Management, 2015a). Figure 8.1.15-4shows the distribution of High Priority (Priority 1, 2 and adjacent Priority 3) AMLs in Washington, where Priority 1 and 2 sites pose a significant risk to human health and safety, and Priority 3 sites pose a risk to the environment. As of November 2015, Washington had 59 Priority 1 and 2 AMLs, with no unfunded problem areas (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2015a).

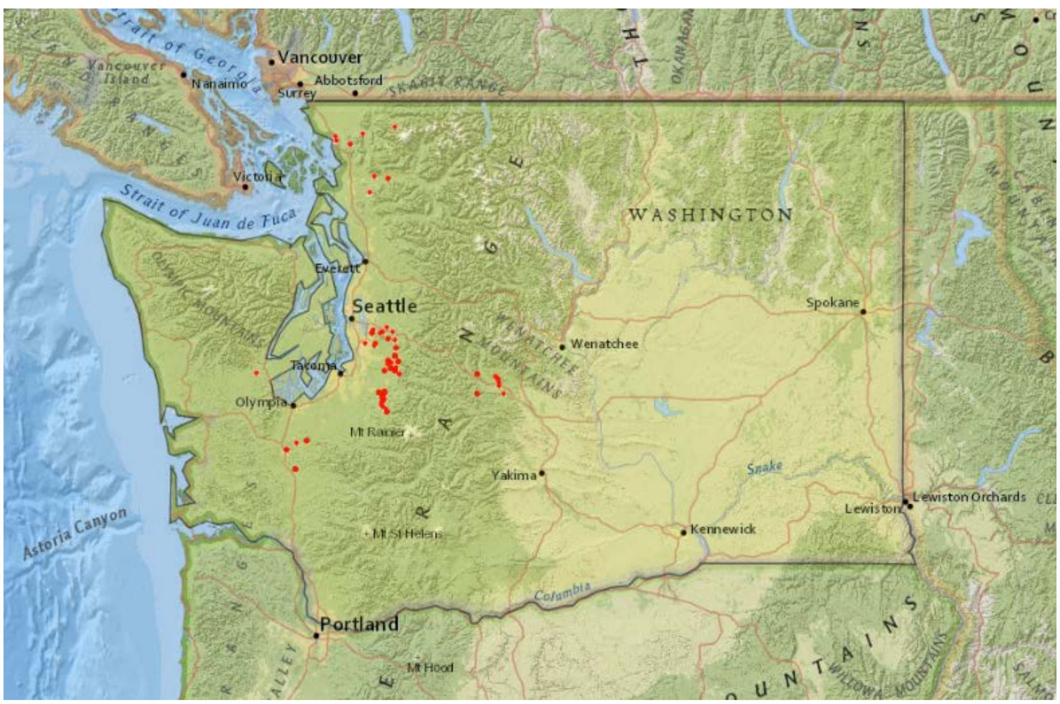


Figure 8.1.15-4: High Priority Abandoned Mine Lands in Washington (2015)

Source: (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2015b)

Telecommunication Worker Occupational *Health and Safety*

Telecommunications sites may be on or near AMLs or mine fires, presenting occupational exposure risks from fire, toxic gases, and subsidence during FirstNet deployment, operation, and maintenance activities. Because the locations of many abandoned mines are unknown or hidden, these mines pose a risk to telecommunications workers because they may be encountered during deployment and maintenance operations.

Public Health and Safety

Subterranean mines present additional health and safety risks to the public, by generating toxic combustible gases, which can penetrate the surface through ground fractures, potentially seeping into residential structures. Additionally, mine fires can consume enough sub-surface material, that risk of subsidence increases. As a result, AMLs and mine fires in particular, can result in evacuations of entire communities (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2015c).

8.1.15.6. Environmental Setting: Natural and Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the public. Telecommunications, including public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Hazardous chemicals and sanitary wastes often contaminate floodwaters, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003). High-risk targets for terror attacks include government centers, military bases, industrial facilities, and airfields, etc. As such, Washington presents an inherent risk for this type of disaster.

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 Washington Natural Disaster Sites: Oso Landslide (SR530 Landslide)

On March 22, 2014, a 650-foot hillslope collapsed in Oso, WA (Snohomish County), initiating the largest recorded landslide and debris flow in U.S. history. The landslide moved an estimated 18 million tons of sediments (enough to cover "600 football fields 10 feet deep"), and crossed the North Fork Stillaguamish River floodplain (Figure 8.1.15-5) in 60 seconds with speeds averaging 40 miles per hour (USGS, 2015j). Experts believe the landslide was caused by heavy rainfall three weeks prior and unstable soil conditions.

The Oso landslide inundated the nearby Steelhead Haven community, destroying 50 homes, killing 43 people and injuring 10 others. Portions of State Route 530 (SR 530), which serves as the primary transit route between Arlington, WA and Darrington, WA, were buried, resulting in a complete road closure for two months. The economic cost was $50M. (National Science Foundation, 2014) Rescue and recovery operations were hindered due to treacherous site conditions and critical road closures, requiring detours using a single-lane powerline access road, and helicopter rescues for 14 people. Additionally, the Snohomish County Emergency Operations Center was activated for 40 days, the longest in Snohomish County history. (Washington State Department of Transportation and Snohomish County Public Works, 2015)

Washington experiences hundreds to thousands of landslides annually, ranking it among the top landslide-prone states in the United States. As a result, the Washington Department of Transportation budgets $15M per year for roadway maintenance and repair due to landslides. (Washington State Department of Natural Resources, 2015j)

Figure 8.1.15-5: Aerial View of the Oso Landslide and Damage to SR 530

Source: (Washington State Department of Transportation and Snohomish County Public Works, 2015)

Telecommunication Worker Occupational Health and Safety

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

Currently, DOH 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 712 NRC-reported incidents for Washington in 2015 with known causes, 17 were attributed to natural disaster (natural phenomenon), and 695 were attributed to manmade disasters (equipment failure and operator error). For example, in January 2015, equipment failure on a generator fuel tank at a shellfish hatchery in Quilcene, WA, caused a release of 150 gallons of diesel fuel down a storm drain and into Dabob Bay (U.S. Coast Guard, 2015). Such incidents present unique, hazardous challenges to telecommunication workers responding during natural or manmade disasters.

P*ublic Health and Safety*

Hazards present during natural and manmade disasters are often far-reaching, affecting large geographic areas and affecting all populations living within the area. Similar to telecommunication workers, the general public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities, potential for exposure to unknown chemical and biologic hazards, and inadequate medical support. In 2014, Washington had the most dangerous weather in the United States, with 50 weather-related fatalities (43 due to the March 22, 2014 Oso landslide (Figure 8.1.15-5), 2 due to wind and 5 due to unknown causes) and 34 non-fatal injuries (NWS, 2015b). By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year (NWS, 2015c).

8.2. ENVIRONMENTAL CONSEQUENCES

This section describes the potential environmental impacts, beneficial, or adverse, resulting from the Proposed Action and Alternatives. As this is a programmatic evaluation, site- and project-specific issues are not assessed. The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews.

At the programmatic level, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Each resource area identifies the range of possible impacts on resources for the Proposed Action and Alternatives, include the No Action Alternative. The No Action 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.

8.2.1. Infrastructure

8.2.1.1. Introduction

This section describes potential impacts to infrastructure in Washington associated with construction, deployment, and operation of the Proposed Action and Alternatives. Chapter 9, Best Management Practices 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.

8.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 8.2.1-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to infrastructure addressed in this section are presented as a range of possible impacts.

Table 8.2.1-1: Impact Significance Rating Criteria for Infrastructure

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

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

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

NA = Not Applicable

8.2.1.3. 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 8.2.1-1, such impacts would be less than significant due to the temporary nature of the deployment activities, even if impacts would be realized at one or more isolated locations. These impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

Capacity of Local Health, Public Safety, and Emergency Response Services

The capacity of local health, public safety, and emergency response services would experience less than significant impacts during construction or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare, if 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 local health, public safety, and emergency response services through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders to communicate during emergency response situations. Based on the impact significance criteria presented in Table 8.2.1-1, potential negative impacts would be less than significant. Substantial beneficial impacts are likely to result from implementation.

Modifies Existing Public Safety Response Telecommunication Practices, Physical Infrastructure, or Level of Service in a manner that directly affects Public Safety Communication Capabilities and Response Times

The Proposed Action and Alternatives contemplated by FirstNet would not cause negative impacts to existing public safety response telecommunication practices, physical infrastructure, or level of service in a manner that directly affects public safety communication capabilities and response times. Based on the impact significance criteria presented in Table 8.2.1-1, 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 complement such practices and SOPs in a positive manner; therefore, only beneficial or complementary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience such beneficial impacts through enhanced 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. Any negative impacts would be expected to be less than significant given the short-term nature of the deployment activities.

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

Commercial assets would be using a different spectrum for communications; as such commercial telecommunication systems, communications, or level of service would experience no impacts. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, such spectrum use may be over-built or under-utilized.[150] Anticipated impacts would be less than significant due to the limited extent and temporary nature of the deployment.

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

The activities proposed by FirstNet would have less than significant impacts on utilities, including electric power transmission facilities, and water and sewer facilities. Depending on the specific project contemplated, installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on a temporary or permanent basis. Also, depending on the specific project contemplated, the draw or use of power from the transmission facilities may need to be examined; however, it is not anticipated that such use of 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.

8.2.1.4. 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.

[150] 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.

Deployment Impacts

As described in Section 2.1, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to infrastructure and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to infrastructure resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would have no impacts to infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any impacts to infrastructure resources, given that construction activities would occur on existing structures, would not be expected to interfere with existing equipment, and transportation capacity and safety, and access to emergency services would not be impacted.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to infrastructure as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of direct interface with existing infrastructure, most notably existing telecommunication infrastructure.

The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to infrastructure include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs), 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 or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact, other than harbor operations. However, impacts to infrastructure resources could potentially occur as result of the construction of landings and/or facilities on shores or banks of waterbodies that accept submarine cable, depending on the exact site location and proximity to existing infrastructure.
    - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment such as small boxes or huts, or access roads, could potentially impact infrastructure. Impacts could include disruption of service in transportation corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.
- Wireless Projects
    - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current utility services during installation or interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. In addition, installation activities would have beneficial impacts due to expansion of infrastructure at a local level. Such activities could enhance public safety infrastructure, and other telecommunications as the site could potentially be available for subsequent collocation.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would result in localized impacts to that tower and such as minor disruptions in services. As a result of collocation of equipment, the potential addition

of power units, structural hardening, and physical security measures could potentially have beneficial impacts on existing infrastructure assets, depending on the site specific plans.

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

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. These impacts are expected to be less than significant as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the on-going phase of deployment, and minor. Chapter 9, 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.

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, and therefore less than significant.

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would also likely result in substantial improvements in level of service and communications capabilities. Operation of the NPSBN is intended to involve high-speed data capabilities, location information, images, and eventually streaming video, which would likely significantly improve communications and the ability of the public safety community to effectively engage and respond. The NPSBN is also intended to have a higher level of redundancy and resiliency than current commercial networks to support the public safety community effectively, even in events of extreme demand. This improvement in the level of resiliency and redundancy is intended to increase the reliability of systems, communications, and level of service, and also minimize disruptions and misinformation resulting from limited or disrupted service. Chapter 9, 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.

8.2.1.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try and avoid any negative impacts to such resources. . Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access road or utility ROW, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts would likely still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated deployment or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to infrastructure as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 8.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

8.2.2. Soils

8.2.2.1. Introduction

This section describes potential impacts to soil resources in Washington associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 8.2.2-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to soil resources addressed in this section are presented as a range of possible impacts.

Table 8.2.2-1: Impact Significance Rating Criteria for Soils

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than significant with BMPs and mitigation measures incorporated**	**Less than significant**	**No impact**
Soil erosion	Magnitude or Intensity	Severe, widespread, and observable erosion in comparison to baseline, high likelihood of encountering erosion-prone soils.	Effect that is potentially significant, but with mitigation is less than significant.	Perceptible erosion in comparison to baseline conditions; low likelihood of encountering erosion-prone soil types.	No perceptible change in baseline conditions.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	Chronic or long-term erosion not likely to be reversed over several years.		Isolated, temporary, or short-term erosion that that is reversed over few months or less.	NA
Topsoil mixing	Magnitude or Intensity	Clear and widespread mixing of the topsoil and subsoil layers.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal mixing of the topsoil and subsoil layers has occurred.	No perceptible evidence that the topsoil and subsoil layers have been mixed.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	NA		NA	NA
Soil compaction and rutting	Magnitude or Intensity	Severe and widespread, observable compaction and rutting in comparison to baseline.	Effect that is potentially significant, but with mitigation is less than significant.	Perceptible compaction and rutting in comparison to baseline conditions.	No perceptible change in baseline conditions.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	Chronic or long-term compaction and rutting not likely to be reversed over several years.		Isolated, temporary, or short term compaction and rutting that is reversed over a few months or less.	No perceptible change in baseline conditions.

NA = Not Applicable

8.2.2.3. Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern for nearly every construction activity that involves ground disturbance. Construction erosion typically only occurs in a small area of land with the actual removal of vegetative cover from construction equipment or by wind and water erosion. Of concern in Washington and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment could impair water and habitat quality, and potentially affect aquatic plants and animals (USDA NRCS, 2000). Areas exist in Washington that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Albolls, Aqualfs, Aquands, Aquents, Aquepts, Aquods, Aquolls, Calcids, Cambids, Cryands, Cryepts, Cryods, Durids, Fluvents, Hemists, Humods, Humults, Ochrepts, Orthents, Orthods, Psamments, Saprists, Udands, Udepts, Vitrands, Xeralfs, Xerands, Xerepts, and Xerolls (see Section 8.1.2.4, Soil Suborders and Figure 8.1.2-2).

Based on the impact significance criteria presented in Table 8.2.2-1, building of some of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. For the majority of projects, impacts to soils would be expected to be less than significant given the short-term and temporary duration of the activities.

To the extent practicable, FirstNet would attempt to minimize ground-disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures, where practicable and feasible, to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 9).

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 8.2.2-1, and due to the relatively small-scale (less than 1 acre) of most FirstNet Proposed Action sites, as well as the implementation of BMPs and mitigation measures (Chapter 9), minimal topsoil mixing is anticipated.

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 8.1.2.4, Soil Suborders). The most compaction susceptible soils in Washington are hydric soils with poor drainage conditions, which include Aqualfs, Aquands, Aquents, Aquepts, Aquods, Aquolls, Hemists, and Saprists. These suborders constitute approximately 5.5 percent of Washington's land area,[151] mostly in the southwestern and northeastern portions of the state (see Figure 8.1.2-2). 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 8.2.2-1, 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 (see Chapter 9).

8.2.2.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit– New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand-holes, pulling vaults, junction boxes, huts, and POP structures and would not impact soil resources because it would not produce perceptible changes to soil resources.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no impacts to soil resources. If physical access were required to light dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite phones, and video cameras, would not impact soil resources because those activities would not require ground disturbance.

[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.

Activities with the Potential to Have Impacts

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

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

associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads, and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way for deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. If usage of heavy equipment as part of routine maintenance or inspections occurs off 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. Chapter 9, 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.

8.2.2.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to soil resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas. However, these potential impacts are expected to be less than significant due to the small scale and short term nature of the deployment. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to soil resources associated with routine inspections of deployable assets, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. If usage of heavy equipment as part of routine maintenance or inspections occurs off 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to soil resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 8.1.2, Soils.

8.2.3. Geology

8.2.3.1. Introduction

This section describes potential impacts to Washington geology resources associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 8.2.3-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to geology addressed in this section are presented as a range of possible impacts.

Table 8.2.3-1: Impact Significance Rating Criteria for Geology

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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than significant with BMP and mitigation measures incorporated**	**Less than significant**	**No impact**
	Duration or Frequency	NA		NA	NA
Land Subsidence	Magnitude or Intensity	High likelihood that a project activity could be located within an area with a hazard for subsidence (e.g., karst terrain).	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located within an area with a hazard for subsidence.	Project activity located outside an area with a hazard for subsidence.
	Geographic Extent	Areas with a high hazard for subsidence (e.g., karst terrain) are highly prevalent within the state/territory.		Areas with a high hazard for subsidence occur within the state/territory, but may be avoidable.	Areas with a high hazard for subsidence do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Potential Mineral and Fossil Fuel Resource Impacts	Magnitude or Intensity	Severe, widespread, observable impacts to mineral and/or fossil fuel resources.	Effect that is potentially significant, but with mitigation is less than significant.	Limited impacts to mineral and/or fossil resources.	No perceptible change in mineral and/or fossil fuel resources.
	Geographic Extent	Regions of mineral or fossil fuel extraction areas are highly prevalent within the state/territory.		Mineral or fossil fuel extraction areas occur within the state/territory, but may be avoidable.	Mineral or fossil fuel extraction areas do not occur within the state/territory.
	Duration or Frequency	Long-term or permanent degradation or depletion of mineral and fossil fuel resources.		Temporary degradation or depletion of mineral and fossil fuel resources.	NA
Potential Paleontological	Magnitude or Intensity	Severe, widespread, observable impacts to paleontological resources.	Effect that is potentially significant, but with mitigation is less than significant.	Limited impacts to paleontological and/or fossil resources.	No perceptible change in paleontological resources.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than significant with BMP and mitigation measures incorporated**	**Less than significant**	**No impact**
Resources Impacts	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory.		Areas with known paleontological resources occur within the state/territory, but may be avoidable.	Areas with known paleontological resources do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Surface Geology, Bedrock, Topography, Physiography, and Geomorphology	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes.	Effect that is potentially significant, but with mitigation is less than significant.	Minor degradation or alteration of surface geology, bedrock, topography that do not result in measurable changes in physiographic characteristics or geomorphological processes.	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes.
	Geographic Extent	State/territory.		State/territory.	NA
	Duration or Frequency	Permanent or long-term changes to characteristics and processes.		Temporary degradation or alteration of resources that is limited to the construction and deployment phase.	NA

NA = Not Applicable

8.2.3.3. Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, landslides, and volcanic activity, and those that would be impacts from the project, such as land subsidence and effects on mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Seismic Hazard

A concern related to deployment is placement of equipment in highly active seismic zones. Equipment that is exposed to earthquake activity is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. As discussed in Section 8.1.3.8, Washington is at risk to severe earthquake events. As shown in Figure 8.1.3-5, western Washington is more susceptible to earthquakes than the remainder of the state. The largest earthquake ever recorded in Washington measured 6.8 on the Richter scale. Based on the impact significance criteria presented in Table 8.2.3-1, seismic impacts from deployment or operation of the Proposed Action would have no impact on seismic activity; however, seismic impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within high-risk earthquake hazard zones. Given the potential for severe earthquakes in or near Washington, some amount of infrastructure could be subject to earthquake hazards. Chapter 9, 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.

Volcanic Activity

As discussed in Section 8.1.3.8, Washington is at risk to volcanic eruptions. Each of Washington's five volcanoes has erupted within the last 4,000 years, including Mount Saint Helens, which erupted in May 1980. Based on the impact significance criteria presented in Table 8.2.3-1, volcanic impacts would be less than significant if FirstNet's deployment locations were within an area with low likelihood of exposure to volcanic ash. Equipment that is exposed to volcanic activity is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. Given the potential for volcanic eruptions in or near Washington, some amount of infrastructure could be subject to volcanic hazards. Chapter 9, 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 s.

Landslides

Similar to seismic hazards, another concern would be placement of equipment in areas that are highly susceptible to landslides. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss.

As discussed in Section 8.1.3.8, portions of Washington, particularly along the Snake and Columbia Rivers, Puget Sound coastline, and western portion of the Olympic Peninsula, are at moderate to high risk of experiencing landslide events. Based on the significance criteria presented in Table 8.2.3-1, potential impacts to landslides from deployment or operation of the Proposed Action would have less than significant impacts as it is likely that the project would attempt to avoid areas that are prone to landslides. However, landslide impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. There is high potential for landslides in the cities of Seattle, Olympia, Everett, and Bremerton. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that several of Washington's major cities, are in or near areas that experience landslides with moderate to high frequency, some amount of infrastructure could be subject to landslide hazards. Chapter 9, 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.

Land Subsidence

Equipment that is exposed to land subsidence, such as sinkholes created by karst topography, is subject to misalignment, alteration, or, in extreme cases, destruction. All of these activities could result in connectivity loss.

As discussed in Section 8.1.3.8 and shown in Figure 8.1.3-6, portions of Washington are vulnerable to land subsidence due to karst topography. Based on the significance criteria presented in Table 8.2.3-1, potential impacts to soil subsidence from deployment or operation of the Proposed Action would have less than significant impacts. However, subsidence impacts to the Proposed Action could be potentially significant to the Proposed Action if FirstNet's deployment locations were within areas at high risk to karst topography or mining areas. To the extent practicable, FirstNet would avoid deployment in known areas of karst topography. However, where infrastructure is subject to subsidence hazards, BMPs and mitigation measures, as discussed in Chapter 9, could help avoid or minimize the potential impacts. Chapter 9, 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.

Potential Mineral and Fossil Fuel Resource Impacts

Equipment deployment near mineral and fossil fuel resources is not likely to affect 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 8.2.3-1, impacts to mineral and fossil fuel resources is unlikely, as the Proposed Action could only be potentially significant if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. To the extent practicable, FirstNet would avoid construction in areas where these resources exist. Chapter 9, 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.

Potential Paleontological Resource Impacts

Equipment installation and construction activities that require ground disturbance could damage existing paleontological resources, which are both fragile and irreplaceable. Based on the impact significance criteria presented in Table 8.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 8.1.3.6, fossils are abundant throughout parts of Washington, particularly the northern and coastal areas. It is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized. Potential impacts to paleontological resources should be considered on a site-by-site basis, and BMPs and mitigation measures could further help avoid or minimize the potential impacts. Chapter 9, 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.

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 8.2.3-1, impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and less than significant as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures could be implemented to help avoid or minimize the potential impacts. Chapter 9, 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.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

Implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities have the potential to be impacted by geologic hazards, some activities could result in potential impacts to geology, and other activities would have no impacts. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. In most cases, there would be no impacts to geologic resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact geologic resources, it is anticipated that this activity would have no impact on geologic resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral and fuel resources and paleontological resources. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use

of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.

  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, minor earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water is not expected to impact geologic resources, including marine paleontological resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or 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 disturbance of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where

deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact to the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could result in incidental removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., minor earthquakes, 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. For the same reason, impacts to deployment from geologic hazards are likely to be less than significant as well. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

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

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. Chapter 9, 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.

8.2.3.4. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

Implementation of deployable technologies on existing paved surfaces would not result in impacts to geologic resources (or from geologic hazards) as there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs) 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to geologic resources (or from geologic hazards) associated with routine inspections of the Preferred Alternative because there would be no ground disturbance.

The operation of the Deployable Technologies Alternative could be affected by to geologic hazards including seismic activity, 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to geologic resources (or from geologic hazards) as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 8.1.3, Geology.

8.2.4. Water Resources

8.2.4.1. Introduction

This section describes potential impacts to water resources in Washington associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 8.2.4-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to water resources addressed in this section are presented as a range of possible impacts.

Table 8.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than significant with BMPs and mitigation measures incorporated**	**Less than significant**	**No impact**
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, SDWA.	Effect that is potentially significant, but with mitigation is less than significant.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than six months.	NA
Floodplain degradation*	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	Impact Level: Less than significant with BMPs and mitigation measures incorporated	Impact Level: Less than significant	Impact Level: 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.		Impact is temporary, lasting no more than one season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, lasting no more than six months.	NA
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge.	Effect that is potentially significant, but with mitigation is less than significant.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody (stream height).
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	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.		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). (See http://www.archives.gov/federal-register/codification/executive-order/11988.html and https://www.federalregister.gov/articles/2015/02/04/2015-02379/establishing-a-federal-flood-risk-management-standard-and-a-process-for-further-soliciting-and).
NA = Not Applicable

8.2.4.3. Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the CWA requires states to assess and report on the quality of waters in their state. Section 303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

All of the surface waters in the state have been degraded to some extent. Approximately 80 percent of Washington's rivers and streams, 68 percent of the state's lakes and streams, and more than half of Washington's coastal waters are impaired (see Table 8.1.4-2). The main causes of impairments include temperature, pathogens, dissolved oxygen, and invasive exotic species. (USEPA, 2008)

Deployment activities could contribute pollutants in a number of ways but the primary likely manner is increased sediment in surface waters. Vegetation removal onsite exposes soils to rain and wind that could increase erosion. Impacts to water quality may occur from post construction vegetation management, such as herbicides, that may leach into groundwater or move to surface waters through soil erosion or runoff, spray drift, or inadvertent direct overspray. Fuel, oil, and other lubricants from equipment could contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, pH or dissolved oxygen levels, water odor, color, or taste, or addition of suspended solids.

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

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs could reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA, SDWA), and local regulations, cause a threat to the human environment, biodiversity, or ecological integrity through water degradation, or cause a sediment water quality violation from local construction, or otherwise substantially degrade water quality.

Therefore, based on the impact significance criteria presented in Table 8.2.4-1, water quality impacts would likely be less than significant and could be further reduced, particularly 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] or tower construction were to occur near or below the existing water table (depth to water), then dewatering would be anticipated at the location. Residual contaminated groundwater could be encountered during dewatering activities. Construction activities would need to comply with Washington dewatering requirements. Any groundwater extracted during dewatering activities, or subject to the terms of a dewatering permit, may be required to or as required by a dewatering permit would be treated prior to discharge or disposed of at a wastewater treatment facility.

Trenching would not likely introduce new contamination in the state's aquifers. Thus, it is unlikely that the majority of FirstNet's deployment locations would result in a drinking water violations, or otherwise substantially degrade groundwater quality. Therefore, and based on the impact significance criteria presented in Table 8.2.4-1, there would likely be less than significant impacts on groundwater quality. In areas where groundwater is close to the surface, (e.g., along the coast) 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 human beings, buildings, roads and other infrastructure. The 500-year floodplain is the area of minimal flood hazard, where there is a 0.2-percent-annual-chance flood. Some projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 8.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet's deployment, on the watershed or subwatershed level, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede or redirect flood flows or impact floodplain hydrology, and would not occur during flood events with the exception of deployable technologies which may be deployed in response to an emergency. Additionally, any effects

[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).

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, and
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures could reduce the risk of additional impacts to floodplain degradation (see Chapter 9).

Drainage Pattern Alteration

Flooding and erosion from land disturbance could changes drainage patterns. Stormwater runoff causes erosion while construction activities and land clearing could change drainage patterns. Clearing or grading activities, or the creation of walls or berms, could alter water flow in an area or cause changes to drainage patterns. Drainage could be directed to stormwater drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage could cause increased erosion, changes in stormwater runoff, flooding, and damage to water quality. Existing drainage patterns could be modified by channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 8.2.4-1, 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 onsite and does not flow to or impact surface waterbodies offsite on other properties,
- Activities designed so that the amount of stormwater generated before construction is the same as afterwards, and
- 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 and mitigation measures could be implemented to further reduce any potentially significant impacts.

[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." (USGS, 2016b)

Flow Alteration

Flow alteration refers to the modification of flow characteristics, relative to natural conditions. Human activities may change the amount of water reaching a stream, divert flow through artificial channels, or alter the shape and location of streams. Surface water and groundwater withdrawals could alter flow by reducing water volumes in streams. Withdrawals may return to the surface/groundwater system at a point further downstream, be removed from the watershed through transpiration by crops, lawns or pastures, or be transferred to another watershed altogether (e.g., water transferred to a different watershed for drinking supply). Altered flow could increase flooding and introduce more erosion and potential for pollution. Alternatively, if water is diverted from its normal flow, the opposite may occur; wetlands and streams may not receive as much water as necessary to maintain the ecology and previous functions.

Activities that do not impact discharge or stage of waterbody (stream height) are not anticipated to have an impact on flow, according to Table 8.2.4-1. 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 pursuant to floodplain management regulations,
- Land uses that are maintaining or increasing pervious surfaces,
- Land uses that do not change the flow of water or drainage patterns offsite or into surface water bodies that have not received that volume of stormwater previously, and
- Minor clearing or grading activities.

Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be less than significant 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 8.1.4.7, approximately 60 percent of residents draw drinking water from Washington’s groundwater resources. Generally, the water quality of Washington’s aquifers is suitable for drinking and daily water needs. (Washington Department of Ecology, 2015k) Groundwater is an important natural resource used by industrial, commercial, agricultural, and residential uses for manufacturing, irrigation, and drinking water purposes. Once a groundwater supply is exhausted or contaminated, it is very expensive, and sometimes impossible, to replace. Water supply demand from the deployment activities is unlikely to exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would be unlikely to cause significant impacts to water quality due to the expected small volume of these materials. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction, and
- Any liquid waste, including but not limited to wastewater, generation, and
- 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 8.2.4-1, potentially significant impacts to groundwater or aquifer characteristics would only occur if actions resulted in substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime on a watershed or within multiple watersheds that is ongoing and permanent. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

8.2.4.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1 Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

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

- Wired Projects
  - *Use of Existing Conduit – New Buried Fiber Optic Plant:* Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to water resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Lighting up of dark fiber would have no impacts to water resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - *Satellite-Enabled Devices and Equipment:* It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.
  - *Deployment of Satellites:* FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant:* Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.
  - *New Build – Submarine Fiber Optic Plant:* The installation of cables in limited nearshore and inland bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to marine and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
  - *New Build – Aerial Fiber Optic Plant:* Potential impacts would be similar to Buried Fiber

Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.

- *Collocation on Existing Aerial Fiber Optic Plant:* Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality form 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 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 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 due to the small scale of individual activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure would likely be less than significant due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is complete. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along exiting roads and utility rights-of-way. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected. Chapter 9, 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.

8.2.4.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Therefore, potential impacts to water resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to water resources if those activities occured on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving, however, these activities would be isolated and short term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites and from fuels leaking into surface or groundwater. However, spills from vehicles or machinery used during deployment tend to be associated with re-fueling operations, and as such, would likely be a few gallons or less in volume and would likely be easily contained or cleaned up, and therefore would have less than significant impacts. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be no impacts to water resources associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies.. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies, however, due to the limited and temporary nature of the deployable activities, it is anticipated that these potential impacts would be less than significant. 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to water resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 8.1.4, Water Resources.

8.2.5. Wetlands

8.2.5.1. Introduction

This section describes potential impacts to wetlands in Washington associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 8.2.5-1. 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 8.2.5-1: Impact Significance Rating Criteria for Wetlands

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

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than significant with BMPs and mitigation measures incorporated	Impact Level: Less than significant	Impact Level: No impact
degradation (spills or sedimentation)	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Indirect effects:[b] change in function(s)[c] change in wetland type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.).	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No changes in wetland function or type.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Long-term or permanent.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA

[a] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories. Category 1 are the highest quality, highest functioning wetlands
[b] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type
[c] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

NA = Not Applicable

8.2.5.3. Description of Environmental Concerns

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

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

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, light, and other human disturbance. To the extent practicable or feasible, FirstNet and/ or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (see Chapter 9).

There are 872,544 acres of wetlands throughout Washington (USFWS, 2014a). In Washington, the main type of wetlands are palustrine (freshwater) wetlands found on river and lake floodplains across the state, as shown in Figure 8.1.5-1.

Based on the impact significance criteria presented in Table 8.2.5-1, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, the deployment activities would not violate applicable federal, state, and local regulations.

In Washington, as discussed in Wetlands, Section 8.1.5.4, "no authorized regulated activity can cause the loss of waters of the U.S. in a mature forested wetland, bog, bog-like wetlands, aspen-dominated wetlands, alkali wetlands, and wetlands in a dunal system along the Washington coast, vernal pools, camas prairie wetlands, estuarine wetlands, and wetlands in coastal lagoons (USACE — Seattle District, 2012). See Section 8.1.5.4 for a full description of these high quality, or wetlands of special value. If any of the proposed deployment activities were to occur in these high quality wetlands, potentially significant impacts could occur, and therefore, site-specific analysis would be required, in addition to BMPs and mitigation measures to avoid potentially significant impacts to wetlands. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of the

BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Other Direct Effects

Other direct impacts consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, other direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through chemical, mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 8.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) may cause potentially significant impacts. In addition, introduction and establishment of invasive species to high quality wetlands within a watershed or multiple watersheds are potentially significant. Other direct effects to high- and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Examples activities that could have other direct effects to wetlands in Washington include:

- *Vegetation Clearing:* removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.
- *Ground Disturbance:* Increased amounts of stormwater runoff in wetlands could alter water level response times, depths, and duration of water detention. Reduction of watershed infiltration capacity could cause wetland water depths to rise more rapidly following storm events.
- *Direct Hydrologic Changes (flooding or draining):* Greater frequency and duration of flooding could destroy native plant communities, as could depriving them of their water supply. Hydrologic changes could make a wetland more vulnerable to pollution. Increased water depths or flooding frequency from increased impervious surface or vegetation removal could distribute pollutants more widely through a wetland. Sediment retention in wetlands is directly related to flow characteristics, including degree and pattern of channelization, flow velocities, and storm surges.

- *Direct Soil Changes:* Changes in soil chemistry from increased nonpoint pollution[154] or changes increased runoff from impervious surface could lead to degradation of wetlands that have a specific pH range and/or other parameter, such as the acidic conditions of bogs and alkaline conditions of fens (which are high quality wetlands in Washington).
- *Water Quality Degradation (spills or sedimentation):* The loss of wetlands results in a depletion of water quality both in the wetland and downstream. Filtering of pollutants by wetlands is an important function and benefit. High levels of suspended solids (sedimentation) could reduce light penetration, dissolved oxygen, and overall wetland productivity. Toxic materials in runoff could interfere with the biological processes of wetland plants, resulting in impaired growth, mortality, and changes in plant communities.

Indirect effects:[155] Change in Function(s)[156] or Change in Wetland Type

The construction of curb and gutter systems diverts surface runoff and could cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to high- and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures, as practicable and feasible (see Chapter 9).

Examples of functions related to wetlands in Washington that could potentially be impacted from construction-related deployment activities include:

- *Flood Attenuation:* Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they could lower flood peaks by providing detention of storm flows,
- *Bank Stabilization:* By reducing the velocity and volume of flow, wetlands provide erosion control, floodwater retention, and reduce stream sedimentation,
- *Water Quality:* Water quality impacts on wetland soils could eventually threaten a wetland's existence. Where sediment inputs exceed rates of sediment export and soil consolidation, a wetland would gradually become filled,
- *Nutrient Processing:* Wetland forests retain ammonia during seasonal flooding. Wetlands absorb metals in the soils and by plant uptake via the roots. They also allow metabolism of

[154] Nonpoint source pollution: A source of pollution that does not have an identifiable, specific physical location or a defined discharge point. Non-point source pollution includes nutrients that run off croplands, lawns, parking lots, streets and other land uses. It also includes nutrients that enter waterways via air pollution groundwater, or septic systems. (USEPA, 2015a)

[155] 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

[156] 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.

oxygen-demanding materials and reduce fecal coliform populations. These pollutants are often then buried by newer plant material, isolating them in the sediments,

- *Wildlife Habitat:* Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding could harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes could have impacts on the preferred food supply and animal cover,
- *Recreational Value:* Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography, and
- *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 8.2.5-1, impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity), would be considered potentially less than significant. Since the majority of the 872,544 acres wetlands in Washington are not considered high quality (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.), deployment activities could have less than significant indirect impacts on wetlands in the state. In areas of the state with high quality wetlands, there could be potentially significant impacts at the project level that would be analyzed on a case-by-case basis. If avoidance were not possible, BMPs and mitigation measures would help to mitigate impacts. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

8.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations would be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

As described in Section 2.1, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wetlands and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - *Use of Existing Conduit* – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - *Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable:* Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.
- Satellites and Other Technologies
  - *Satellite-Enabled Devices and Equipment:* It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launches for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.
  - *Deployment of Satellites*: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact on wetlands.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - *New Build – Buried Fiber Optic Plant:* Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.

  - *New Build – Submarine Fiber Optic Plant:* The installation of cables in limited nearshore and inland bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments, including coastal and marine environments.
  - *New Build – Aerial Fiber Optic Plant:* Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
  - *Collocation on Existing Aerial Fiber Optic Plant:* Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.
  - *Installation of Optical Transmission or Centralized Transmission Equipment:* If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
- Wireless Projects
  - *New Wireless Communication Towers:* Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - *Collocation on Existing Wireless Tower, Structure, or Building:* Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - *Deployable Technologies:* Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands

if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, blimps, or piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be less than significant due to the small amount of land disturbance (generally less than one acre) and the short timeframe of deployment activities. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing potential other direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are expected to be less than significant due to the limited nature of deployment activities. It is also anticipated that routine maintenance activities would be conducted on existing roads and utility ROW. Chapter 9, 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.

8.2.5.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be less than significant due to the small scale and temporary duration of expected FirstNet deployment activities in any one location. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance could result in impacts similar to the abovementioned deployment impacts. The wetlands impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the wetland's quality and function.

It is anticipated that there would be less than significant impacts to wetlands associated with routine inspections of the Deployable Technologies Alternative, as it is likely existing roads and utility ROW would be used for maintenance and inspection activities. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects to wetlands due to the limited nature of site maintenance activities, including mowing and application of herbicides. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 8.1.5, Wetlands.

8.2.6. Biological Resources

8.2.6.1. Introduction

This Chapter describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Washington associated with deployment and operation of the Proposed Action and its Alternatives. Chapter 9, 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.

8.2.6.2. 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 8.2.6-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 8.2.6.3, 8.2.6.4, and 8.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 8.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Washington.

Table 8.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than significant with BMPs and mitigation measures incorporated	Less than significant	No impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury /mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including: Marine Mammal Protection Act (MMPA), Magnuson Stevens Fishery Conservation And Management Act (MSFCMA), MBTA, and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed within Washington for at least one species. Anthropogenic[a] disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than significant with BMPs and mitigation measures incorporated	Less than significant	No impact
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Habitat alteration in locations not designated as vital or critical for any period. Temporary losses to individual plants within cover types, or small habitat alterations take place in important habitat that is widely distributed and there are no cover type losses or cumulative effects from additional projects.	Sufficient habitat would remain functional to maintain viability of all species. No damage or loss of terrestrial, aquatic, or riparian habitat from project would occur.
	Geographic Extent	Regional effects observed within Washington for at least one species. Anthropogenic disturbances that lead to the loss or alteration of nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Less than significant with BMPs and mitigation measures incorporated	Less than significant	No impact
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances that lead to mortality, disorientation, the avoidance, or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic disturbances are measurable but minimal as determined by individual behavior and propagation, and the potential for habituation or adaptability is high given time.	No stress or avoidance of feeding or important habitat areas. No reduced population resulting from habitat abandonment.
	Geographic Extent	Regional or site specific effects observed within Washington for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience, and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts, resulting in injury or mortality.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than significant with BMPs and mitigation measures incorporated	Less than significant	No impact
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long-term loss of migratory pattern/path or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Temporary loss of migratory rest stops due to anthropogenic activities take place in important habitat that is widely distributed and there are no cumulative effects from additional projects.	No alteration of migratory pathways, no stress or avoidance of migratory paths/patterns due to project.
	Geographic Extent	Regional effects observed within Washington for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

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

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Less than significant with BMPs and mitigation measures incorporated	Less than significant	No impact
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout Washington.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons.	NA

[a] Anthropogenic: “Made by people or resulting from human activities. Usually used in the context of emissions that are produced as a result of human activities” (USEPA, 2016e)
NA = Not Applicable

8.2.6.3. Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in Washington 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 8.2.6-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, FirstNet deployment events are expected to be relatively small in scale and therefore would have less than significant impacts. The implementation of BMPs and mitigation measures and avoidance measures could 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 potential impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat.

Construction of new infrastructure and long-term facility maintenance could result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. In general, these impacts are expected to be less than significant due to the short-term, localized nature of the deployment activities. Further, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case BMPs and mitigation measures could be recommended and consultation with appropriate resource agencies, if required, would be undertaken to minimize or avoid potential impacts. Chapter 9, 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.

Indirect Injury/Mortality

Indirect effects are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality could include stress related to disturbance. The alteration of soils or hydrology within a localized area could result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, such as deciduous and coniferous forests that exist between the coast regions and central regions of the state or old growth forests in and around Mt. Baker-Snoqualmie National Forest, although this is unlikely to occur due to the small size of expected FirstNet activities. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment. Overall, these impacts are expected to be less than significant due to the short-term and small-scale nature of deployment activities. Chapter 9, 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.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for terrestrial vegetation (e.g., forest migration) are expected as a result of the Proposed Action given the small-scale of deployment activities.

Reproductive Effects

No reproductive effects to terrestrial vegetation are expected as a result of the Proposed Action given the small scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species could have a dramatic effect on natural resources and biodiversity. The Washington of Agriculture Plant Protection Division, Plant Services Program maintains a list of plants and seeds whose transportation, distribution, and sales are prohibited in Washington state under WAC 16-752-600 through 660 (WSDA, 2014).

As described in Section 7.1.6.4, when non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. The potential to introduce invasive plants within construction zones and during long-term site maintenance could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. Overall, these potential impacts are expected to be less than significant due to the small-scale, localized nature of deployment activities. Chapter 9, 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.

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[157], and the nature as well as the extent of the habitats affected. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are 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 on terrestrial vegetation because there would be no ground disturbance.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not impact terrestrial vegetation because those activities would not require ground disturbance.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have no impact on terrestrial vegetation.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities

[157] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds (USEPA, 2015u).

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 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 or near bodies of water would not impact terrestrial vegetation. However, impacts to terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept the 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: 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 additional power units are needed, replacement towers, structural hardening, and physical security measures require land clearing or excavation activities, impacts would be similar to new wireless construction.
- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct impacts to terrestrial vegetation if deployment occurs on vegetated areas, or the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact terrestrial vegetation if launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs.

In general the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the vegetation affected. These potential impacts are expected to be less than significant due to the small scale of expected deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. The impacts could vary greatly among species, vegetative community, and geographic region, but are expected to remain less than significant. 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. Chapter 9, BMPs and Mitigation

Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 8.1.6.3, Terrestrial Vegetation.

8.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates occurring in Washington and 'its near offshore environment (i.e., less than two miles from the edge of the coast) are discussed in this section. Chapter 9, 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.

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 8.2.6-1, 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; therefore, impacts are generally expected to be less than significant, as discussed further below. Chapter 9, 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.

<u>Terrestrial Mammals</u>

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Washington. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, foraging, and migration (FHWA, 2009). Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur.

Entanglement in fences or other barriers could be a source of mortality or injury to terrestrial mammals, though entanglements would likely be isolated, individual events.

For example, if tree-roosting bats — particularly maternity colonies — are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small scale and would be dependent on the location and type of deployment activity, and the amount of tree removal. Site avoidance measures could be implemented to avoid disturbance to bats.

Marine Mammals

Marine mammals swimming or hauled out on land are sensitive to boats, aircraft, and human presence. Noises, smells, sounds, and sights may elicit a flight reaction. Trampling deaths associated with haulout disturbance are known source of mortality for seals but are not anticipated from likely FirstNet deployment activities.

Entanglements from marine debris as well as ingestion of marine debris could result in injury or death to marine mammals. Marine debris is any manmade object discarded, disposed of, or abandoned that enters the marine environment. Entanglements from marine debris are not anticipated from FirstNet activities.

The whale species known to occur offshore of Washington are also protected under the ESA. Environmental consequences pertaining to these whales are discussed in Section 8.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and violate MBTA and BGEPA. Generally, collision events occur to night-migrating birds, “poor” fliers (e.g., ducks), heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (Gehring, Kerlinger, & Manville, 2011).

Avian mortalities or injuries could also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds could occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation and trenching, and other ground disturbing activities. Removal of trees during land clearing activities, could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for resting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997).

Direct mortality and injury to birds of Washington are not likely to be widespread or affect populations of species as a whole; impacts to individual birds may be realized depending on the nature of the deployment activity. Direct injury/mortality are not anticipated to be widespread or affect bird due to the small scale of likely FirstNet actions. If siting considerations, BMPs, and mitigation measures are implemented (Chapter 9), potential impacts could be minimized. Additionally, potential impacts under MBTA and BGEPA could be addressed through BMPs and mitigation measures developed in consultation with USFWS.

Reptiles and Amphibians

The majority of Washington's amphibian and reptile species are widely distributed throughout the state; however, some species have more limited ranges. 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.

Two species of marine reptiles – all listed as threatened or endangered under the ESA – occur in Washington's offshore environment. Environmental consequences pertaining to these reptiles are discussed in Section 8.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Washington are so widely distributed that injury/mortality events are not expected to affect populations of species as a whole.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat, and impeding access to resources and mates. There are areas in Washington that have experienced extensive land use changes from urbanization and agriculture. However, there are portions of the state are forested and remain relatively unfragmented.

Additionally, habitat loss could occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the Proposed Action would cause exclusion effects only in very special circumstances, as in most cases an animal could fly, swim, or walk to a nearby area that would provide refuge.

In general, potential effects of vegetation and habitat loss, alteration, or fragmentation are expected to be less than significant because of the small-scale nature of expected deployment activities, as FirstNet would attempt to avoid these areas. These potential impacts are described for Washington's wildlife species below. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Washington and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., black bear) by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals (e.g., bats, foxes) that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures (see Chapter 9).

Marine Mammals

Several different types of marine mammals occur in Pacific coastal waters including whales, dolphins, porpoises, and pinnipeds. Pinnipeds found in Washington may occur in oceans, estuaries, and coastal rivers, porpoises prefer near shore, estuaries, and bays, while whales and dolphins occur primarily in offshore coastal waters. Pinnipeds could be temporarily excluded from a resource due to the presence of humans, noise, or vessel traffic during deployment activities. Effects on pinnipeds from exclusion from resources would be low magnitude and temporary in duration.

Loss of habitat or exclusions from these areas for marine mammals would be avoided or minimized by BMPs and mitigation measures (see Chapter 9). Environmental consequences pertaining to the endangered whales protected under the ESA are discussed in Section 8.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Birds

The direct removal of migratory bird nests is prohibited under the MBTA. The USFWS and the Washington Department of Fish and Wildlife provide regional guidance on the most critical periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation could affect avian species directly by loss of nesting, foraging, stopover, and cover habitats.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced if birds temporarily avoid IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[158] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration could have major impacts to species that migrate in large flocks and concentrate at stopovers (e.g., shorebirds). BMPs and mitigation measures,

[158]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.

including nest avoidance during construction-related activities, would help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for Washington's amphibians and reptiles typically consist of wetlands and the surrounding upland forest. Impacts are expected to be less than significant given the short-term nature and limited geographic scope of individual activities. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 9) would be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 8.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to Washington's amphibian and reptile populations, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.[159]

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. Impacts to sensitive invertebrate species are discussed below in Section 8.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment. Overall, potential impacts are expected to remain less than significant due to the short-term nature and limited geographic scope of expected activities, as FirstNet would attempt to avoid these areas, though BMPs and mitigation measures could further help to avoid or minimize the potential impacts. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Stress from repeated disturbances during critical periods (e.g., roosting and mating) could reduce the overall fitness and productivity of young and adult terrestrial mammals. Indirect effects could occur to roosting bats from noise, light, or human disturbance causing them to leave their roosting locations or excluding them from their summer roosting/maternity colony roosts. For example, some bat species establish summer roosting or maternity colonies in the same general area that they return to year and after year. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur.

[159] See Chapter 9, Wetlands, for a discussion of BMPs for wetlands.

Marine Mammals

Repeated disturbance (e.g., from vessel traffic) could cause stress to individuals resulting in lower fitness and productivity. Given that the majority of FirstNet deployment activities are not expected to be located offshore or in the oceanic environment, less than significant impacts to no impacts would be anticipated for marine mammals.

Birds

Repeated disturbance, especially during the breeding and nesting season, could cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur.

Reptiles and Amphibians

Changes in water quality, especially during the breeding seasons, could cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur.

Terrestrial Invertebrates

Terrestrial invertebrates could experience chronic stress, either by changes in habitat composition or competition for resources, resulting in lower productivity. Due to the large number of invertebrates distributed throughout the state, and given the short-term nature of most of the deployment activities, this impact would likely be less than significant.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. Overall, potential impacts are anticipated to be less than significant due to the small-scale and localized nature of expected activities, as FirstNet would attempt to avoid these areas. Potential effects to migration patterns of Washington’s amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates are described below. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Some large mammals (e.g., black bears) will perform seasonal migrations between foraging/breeding habitats and denning habitats. Some small mammals (e.g., bats) also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula[160].

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

[160] A location chosen by an animal for hibernation.

routes. Impacts could vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be less than significant because they would be unlikely to result in long-term avoidance. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Marine Mammals

Noise associated with the installation of cables in the near/offshore waters of coastal Washington could impact marine mammal migration patterns, though impacts are likely to be short-term provided the noise sources are not wide ranging and below Level A and B sound exposure thresholds[161]. It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. Marine mammals have the capacity to divert from sound sources during migration, and therefore impacts are expected to be less than significant since noise generating activities would be of short duration and are not likely to result in long-term avoidance. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over distances often involving many different countries. For example, as a group, shorebirds migrating through Washington undertake some of the longest-distance migrations of all animals. Washington is located within the Pacific Flyway and has 74 IBAs throughout the state serving as important stopover, breeding, and wintering areas for migratory birds (Audubon Washington, 2015). Many migratory routes are passed from one generation to the next. Impacts could vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, and impacts are expected to be less than significant given the short-term nature and limited geographic scope for individual activities. BMPs and mitigation measures would help to avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of salamanders and frogs are known to seasonally migrate in Washington. Post-metamorphic salamanders, such as the tiger salamander, migrate out of the ponds where they were born and into terrestrial habitats where they live until they move back to ponds to breed as adults. Mortality and barriers to movement could occur as result of the Proposed Action. (Berven & Grudzien, 1990) (Calhoun & DeMaynadier, 2007)

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but and impacts are expected to be less than significant given the short-

[161] Level A: 190 dB re 1µPa (rms) for seals and 180 dB re 1µPa (rms) for whales, dolphins, and porpoises. It is the minimum exposure criterion for injury at the level at which a single exposure is estimated to cause onset of permanent hearing loss. Level B: 160 dB re 1µPa (rms). It is defined as the onset of significant behavioral disturbance is proposed to occur at the lowest level of noise exposure that has a measurable transient effect on hearing (Southall, et al., 2007).

term nature and limited geographic scope of individual activities. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of Washington's terrestrial invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which could affect the overall population of individuals. Overall, potential impacts are anticipated to be less than significant due to the short-term and limited nature of expected activities, as FirstNet would attempt to avoid these areas. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and dens for large mammals, such as the black bear, has the potential to negatively affect body condition and reproductive success of mammals in Washington.

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 signficant. Reproductive effects as a result of displacement and disturbance are minimized through the use of BMPs and mitigation measures.

Marine Mammals

Although unlikely, the displacement of female whales from preferred calving habitats, may reduce fitness and survival of calves potentially affecting overall productivity. However, activities are likely to be small-scale in nature and contribute only minimally to minor, short-term displacement, and BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Disturbance to marine mammals from activities associated with the Proposed Action could result in the abandonment, or death of offspring, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

Birds

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less suitable habitat and thus reduce survival and reproduction. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, 1997). The majority of FirstNet deployment or operation activities are likely to be small-scale in nature.

Applicable BMPs and mitigation measures, as defined through consultation with USFWS for MBTA or BGEPA, if required, could help to avoid or minimize any potential impacts. Environmental consequences pertaining to federally listed species will be discussed in Section 8.2.6.6, Threatened and Endangered Species.

Reptiles and Amphibians

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests, which could result in premature mortality of nesting offspring or eggs. For example, major threats to female Painted turtles are mortality by vehicles while moving to and from nesting sites and from predation on nests and nesting females, which in turn can reduce the reproductive volume of the species if the femal population is reduced (WDNR, 2005).

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, or alter water quality through sediment infiltration or obstruction of natural water flow to pools, though BMPs would help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; therefore, no reproductive effects to terrestrial invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species could have a dramatic effect on natural resources. The Washington Invasive Species Council evaluates over 700 invasive plant, aquatic, and wildlife species in and in close proximity to Washington.

FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites, although these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Therefore, potential impacts are expected to be less than significant.

Potential invasive species effects to Washington's wildlife are described below.

Terrestrial Mammals

In Washington, feral swine and nutria are common nuisance mammals. They destroy native vegetation resulting in erosion and water resource concerns, and could carry/transmit disease to livestock and human beings. Nutria destroy wetland habitats by overgrazing and burrowing into flood control structures (USDA APHIS, 2010). This, in turn, could seriously reduce native populations of animals and lead to the degradation of their habitat.

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations.

Marine Mammals

Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water; therefore, the introduction of non-native species would not occur.

Birds

FirstNet 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 bird species are not expected to be introduced at project sites as part of the deployment activities from machinery or construction workers.

Reptiles and Amphibians

Although FirstNet deployment activities could result in short-term or temporary changes to specific project sites, these sites are expected to return to their natural state in a year or two. Invasive reptile or amphibian species are not expected to be introduced at project sites as part of the deployment activities. Invasive 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 could pose a threat to Washington’s forest and agricultural resources (USDA Forest Service, 2015). Species such as the bark-boring moths, exotic leafrollers, exotic apple fruit pests, lymantriids (gypsy moths), and wood-boring beetles are of particular concern in Washington, 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 could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive terrestrial invertebrate species during implementation of the Proposed Action. Invasive species effects related to terrestrial invertebrates could be minimized with the implementation of BMPs and mitigation measures. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology and the nature and extent of the habitats affected. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on wildlife resources because there would be no ground disturbance.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it 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 wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g. reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.
    - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Impacts may vary depending on the number or individual poles installed and the extent of ground disturbance, but could include direct injury/mortality of individuals as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.
    - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept the submarine cables could potentially impact wildlife (see Section 8.2.4, 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 periods, effects to migratory patterns as well as reproductive effects and indirect injury/ mortality could occur.
    - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as

described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wildlife. However, if additional power units are needed, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, 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 RF 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to wildlife resources 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. Potential spills of these materials would be expected to be in small quantities.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms.

Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and therefore would likely than less than significant given the short-term nature and limited geographic scope for individual activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts because deployable activities are expected to be temporary and likely affecting only a small number of wildlife. The impacts could vary greatly among species and geographic region. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 8.1.6.4, Terrestrial Wildlife.

8.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Washington and ’its near offshore environment are discussed in this section. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events. (USEPA, 2012d)

Based on the impact significance criteria presented in Table 8.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, 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 disturbance 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 potential impacts under the MSFCMA or other sensitive aquatic habitats could be addressed through BMPs and mitigation measures as defined through consultation with the appropriate resource agency.

Indirect Injury/Mortality

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 due to the short-term nature and limited geographic scope of deployment activities. BMPs and mitigation measures to protect water resources (see Section 8.2.4, 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. For example, Washington has several species of anadromous fish that could be impacted when attempting to migrate up rivers to spawn, such as Pacific lamprey, the River lamprey, and Western brook lamprey or the White sturgeon (University of Puget Sound, 2015b). Impacts would vary depending on the species, time of year, and duration of deployment, but would be localized and at a small scale, and therefore are expected to be less than significant. 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 could affect the overall population of individuals. Restrictions to spawning/breeding areas for fish and aquatic invertebrates and the alteration of water quality through sediment infiltration, obstruction of natural water flow, or loss of submerged vegetation resulting from the deployment of various types of infrastructure, are not anticipated, and therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive plants within construction zones could occur from vessels and equipment being transported from one region to another, 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; these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant and animal species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. Chapter 9, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to fisheries and aquatic habitats would be temporary and would not result in any perceptible change..
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts on fisheries and aquatic habitats because there would be no 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 if 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 or near bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept the submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g. mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
    - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an

existing tower, which would not result in impacts to fisheries and aquatic habitats. However, if additional power units are needed, replacement towers, structural hardening, or physical security measures required ground disturbance, impacts would be similar to new wireless construction. For a discussion of RF emissions refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in 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 RF 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 and localized nature of deployment activities that have the potential to impact aquatic habitats. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance activities that may result in accidental spills from maintenance equipment or pesticide runoff near fish habitat are expected to have less than significant effects to fisheries and aquatic habitats. Potential spills of these materials would be expected to be in small quantities.

Fisheries and aquatic habitat could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition, the presence of new access roads and transmission line ROWs near water resources 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts from habitat loss, alteration, and fragmentation, indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant due to the limited nature of expected deployment activities. Chapter 9, 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.

<u>Operational Impacts</u>

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 could vary greatly among species and geographic region. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 8.1.6.5, Fisheries and Aquatic Habitats.

8.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Washington and Washington's offshore environment associated with deployment and operation of the Proposed Action and Alternatives. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, 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 8.2.6-2. 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 8.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect	No Effect
Injury/Mortality of a Listed Species	Magnitude or Intensity	As per the ESA, this impact threshold applies at the individual level so applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under likely to adversely affect category). Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Includes permitted take.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species.	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to infrequent, temporary, and short-term effects.	
Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success of a listed species.	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success.	No measurable effects on listed species.
	Geographic Extent	Reduced breeding success of a listed species at any geographic extent.	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success of listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success of a listed species.	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success of a listed species within a breeding season.	

Type of Effect	Effect Characteristics	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 8.2.6-2, any direct injury or mortality of a listed species at the individual-level, as well as any impact that has the potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency, may affect and likely adversely affect a listed species. Direct injury/mortality environmental concerns pertaining to federally listed terrestrial mammals, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Washington are described below. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

<u>Terrestrial Mammals</u>

Four endangered and six threatened federally listed terrestrial mammal species are known to occur in Washington. They are the Canada lynx, Columbian white-tailed deer, gray wolf, grizzly bear, Olympia pocket gopher (*Thomomys mazama pugetensis*), pygmy Columbia Basin rabbit, Roy Prairie pocket gopher, Tenino pocket gopher, Woodland Caribou , and Yelm pocket gopher (*Thomomys mazama yelmensis*).

Direct mortality to the federally listed Canada lynx, Columbian white-tailed deer, gray wolf, or grizzly bear could occur from vehicle strikes, as these species are occasionally found along transportation corridors. Entanglement in fences or other barriers could also be a source of mortality or injury to these species. Impacts would likely be isolated, individual events and therefore may affect, but are not likely to adversely affect, a listed species.

Direct mortality to the Olympia pocket gopher, pygmy Columbia Basin rabbit, Roy Prairie pocket gopher, Tenino pocket gopher, Washington ground squirrel, or Yelm pocket gopher could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Entanglement in fences or other barriers could also be a source of mortality or injury to these species. Impacts would likely be isolated, individual events and therefore may affect, but are not likely to adversely affect, a listed species.

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Marine Mammals

Two federally listed endangered whale species are known to occur in Washington's near offshore environment; they include the humpback whale and killer whale. Entanglements from marine debris as well as ingestion of marine debris are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. Impacts would likely be isolated, individual events, and therefore may affect, but are not likely to adversely affect, a listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Birds

One endangered and five threatened federally listed bird species known to occur in Washington. These are the marbled murrelet, northern spotted owl , short-tailed albatross (*Phoebastria albatrus*), streaked horned lark , western yellow-billed cuckoo, and western snowy plover. Depending on the project type and location, direct mortality or injury to these birds could occur from collisions or electrocutions with manmade cables and wires, vehicle strikes, or by disturbance or destruction of nests during ground disturbing activities. However, these potential impacts may affect, but are not likely to adversely affect, listed species as FirstNet would attempt to avoid deployment activities in these areas. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Fish

Five fish species are federally listed and known to occur in the state of Washington; they are the bull trout, Chinook salmon,chum salmon, sockeye salmon (*Oncorhynchus nerka*), and steelhead trout. Direct mortality or injury to this species are unlikely but could occur from entanglements resulting from the Proposed Action, but are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

One threatened federally listed amphibian species is known to occur in Washington, the Oregon spotted frog. Direct mortality to this species could occur in construction zones either by excavation activities or by vehicle strikes. Potential effects would likely be isolated, individual events, and FirstNet would attempt to avoid areas where the species may occur. Therefore potential impacts may affect, but would not likely adversely affect, the listed species.

Three federally listed marine reptiles are known to occur in the coastal area and offshore environment of Washington; they are the green sea turtle, leatherback sea turtle, and Loggerhead sea turtle. The majority of FirstNet deployment projects would not occur in an aquatic environment. Direct mortality or injury occurring from watercraft and vessels strikes are unlikely as the majority of the FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but would not likely adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No federally listed terrestrial reptiles are known to occur in Washington. Therefore, no injury or mortality effects to federally threatened and endangered reptiles are expected as a result of the Proposed Action.

<u>Invertebrates</u>

Two federally listed endangered invertebrate species is known to occur in Washington, including the Oregon silverspot butterfly and Taylor's checkerspot. Direct mortality or injury could occur to the Taylor's checkerspot if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. FirstNet would attempt to avoid areas where these species may occur.

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 9, may be implemented as appropriate to further minimize potential impacts.

<u>Plants</u>

Three endangered and eight threatened plants species are federally listed and known to occur in the state of Washington as summarized in Table 8.1.6-8. Direct mortality to federally listed plants could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. FirstNet would attempt to avoid areas where these species may occur; therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, 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 by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which could affect the breeding success. Potential effects to federally listed terrestrial mammals, marine mammals, birds, terrestrial reptiles and marine reptiles, amphibians, fish, invertebrates, and plants with known occurrence in Washington are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect federally listed terrestrial mammals within or near Project activities. For example, Washington's four threatened species of pocket gophers, which include the Olympia pocket gopher, Roy Prairie pocket gopher , Tenino pocket gopher, and Yelm pocket gopher, are among the state's listed species whose habitat loss concern includes urban development (WDFW, 2012a). Grizzly bears face threats from various types of development as well (Servheen, 1993) (USFWS, 2007a). Impacts would be directly related to the frequency, intensity, and duration of these activities; however, they are anticipated to be small-scale and localized. FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Marine Mammals

The federally listed humpback whale found in the offshore areas of Washington are migrants. Therefore, and as the majority of FirstNet deployment projects would not occur in an aquatic environment, no long-term reproductive effects to federally this listed marine mammal is expected as a result of the Proposed Action.

There are three categories of killer whale populations in the coastal waters of Washington: residents,[162] transients,[163] and offshore.[164] Effects to reproduction of this federally listed whale species in Washington is unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Birds

The Short-tailed Albatross and the Western Snowy Plover occur on or near the coast of Washington. The majority of FirstNet deployment activities would not occur on beaches; therefore, impacts to these bird species are not anticipated. The Marbled Murrelet, Northern Spotted Owl, Streaked Horned Lark, and the Western Yellow-billed Cuckoo, occur throughout or in varied habitats of Washington. Noise, light, or human disturbance within nesting areas could cause federally listed birds, such as the yellow-billed cuckoo, to abandon their nests or relocate to less desirable locations, or may result in stress to individuals, reducing survival and reproduction. However, FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation

[162] Resident: "resident in a State if it exists in the wild in that State during any part of its life." (US Legal, 2016a)
[163] Transients: "Transient generally means something that is temporary." (US Legal, 2016b)
[164] Offshore: "beyond the line of ordinary low water along that portion of the coast of the United States that is in direct contact with the open seas and beyond the line marking the seaward limit of inland waters." (US Legal, 2016c)

measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Changes in water quality, especially during the breeding seasons, resulting from ground disturbing activities could cause stress resulting in lower productivity for the Oregon Spotted Frog, found in wetlands in western and central Washington. Impacts to wetlands, noise, and human disturbance during the critical periods (e.g., mating, nesting) could lower fitness and productivity. FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

The three federally listed sea turtles found in the offshore areas of Washington are migrants. Consequently, no long-term reproductive effects to federally listed sea turtles are expected as a result of the Proposed Action.

Fish

Deployment activities resulting in increased disturbance (e.g., humans, noise), especially during spawning activity, and changes in water quality could cause stress resulting in lower productivity (see Section 8.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects to reproduction of the federally listed fish species in Washington, such as the Bull trout or steelhead trout , or the Chinook salmon , Chum salmon (*Oncorhynchus keta*), or Sockeye salmon , are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment and FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

The introduction of invasive plants to habitats utilized by federally listed terrestrial invertebrates could potentially affect these species (USFWS, 2015ah). Potential impacts to federally listed invertebrate species may affect, but are not likely to adversely affect, those species, as FirstNet would attempt to avoid these areas. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Plants

Potential impacts could occur from ground-disturbing activities to listed plant species as a result of the Proposed Action. However, FirstNet would attempt to avoid these areas. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered potentially significant. Potential effects to federally listed terrestrial mammals, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Washington are described below.

Terrestrial Mammals

Habitat loss or alteration, particularly from fragmentation or invasive species, could affect breeding and foraging sites of the federally listed terrestrial mammals, resulting in reduced survival and productivity. However, the localized nature of disturbances during deployment activities are not anticipated to stress federally listed terrestrial mammals. Ground disturbing activities could impact food sources for the federally listed terrestrial mammals, such as the Olympia pocket gopher, in Washington. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species, causing them to abandon breeding locations or alter migration patterns. Terrestrial mammals have the capacity to divert from sound sources during feeding and migration. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Marine Mammals

Noise associated with the installation of cables in the near/offshore waters of coastal Washington could affect marine mammal migration patterns, though impacts are likely to be short-term provided the noise sources are not wide ranging and below Level A and B sound exposure thresholds. ’Marine mammals have the capacity to divert from sound sources during migration. Additionally, the majority of FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over distances often involving many different countries. For example, the yellow-billed cuckoo migrates thousands of miles from their breeding ground in the western United States to their wintering sites in South America. Disturbance in stopover, foraging, or breeding areas (visual or noise) or habitat loss/fragmentation could cause stress to individuals causing them to abandon areas for less desirable habitat and potentially reduce over fitness and productivity. Activities related to the Proposed Action, such as aerial deployment or construction activities, could result in effects to federally listed birds. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Habitat loss or alteration, particularly from fragmentation or invasive species, could affect nesting and foraging sites of the federally listed Oregon spotted frog, resulting in reduced survival and productivity; however, the localized nature of disturbances during deployment activities are not anticipated to stress federally listed reptiles or amphibians. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Fish

Changes in water quality could impact food sources for the federally fish species, such as the sockeye salmon, in Washington. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species causing them to abandon spawning locations or altering migration patterns. Behavioral changes to these listed species are unlikely as the majority of FirstNet deployment projects would not occur in aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Disturbances to food sources utilized by the federally listed Taylor's checkerspot, especially during the breeding season, could impact foraging behavior. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary for geographic extent. In some cases, large-scale impacts could occur that would not diminish the functions and values of the habitat, while in other cases, small-scale changes could lead to potentially significant adverse effects, such as impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically. Potential effects to federally listed terrestrial mammals, marine mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with designated critical habitat in Washington are described below.

Terrestrial Mammals

Five of the federally listed terrestrial mammal species in Washington have federally designated critical habitat. Critical habitat for the Canada lynx was designated in region along the Central-North Region of Washington. Critical habitat for the Olympia pocket gopher was designated in the area around the Olympia Airport south of the cities of Olympia and Tumwater. Critical habitat for the Tenino pocket gopher was designated in the Rock Prairie in Thurston County. Critical habitat for the Woodlan caribou is in the Southern Selkirk Mountains in the northeastern part of the state in Pend Oreille County. Critical habitat for the Yelm pocket gopher was designated in Tenalquot Prairie and Rock Prairie in Thurston County.

Land clearing, excavation activities, and other ground disturbing activities in these critical habitats in Washington could lead to habitat loss or degradation, which could affect these federally listed mammals depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other six federally listed terrestrial mammal species in Washington; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Marine Mammals

Federally designated critical habitat for the killer whale includes three distinctive areas of Puget Sound in Washington, which includes the following counties: Challam, Jefferson, King, Kitsap, Island, Mason, Pierce, San Jan, Skagit, Snohomish, Thurston, and Whatcom. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water and therefore would not likely disturb critical habitat. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed marine mammal species in Washington; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Birds

Four of the federally listed bird species in Washington have federally designated critical habitat. Critical habitat for the marbled murrelet was designated in western Washington. Critical habitat for the northern spotted owl consists areas east and west of the Cascades in Washington. Critical habitat for the streaked horned lark was designated in the coastal and Columbia River regions of Washington. Critical habitat for the western snowy plover has been designated at Copalis Split, Damon Point, Midway Beach, Shoalwater/Graveyard spit, Leadbetter spit, and Gunpowder Sands Island. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the short-tailed albatross or western yellow-billed cuckoo in Washington; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Reptiles and Amphibians

No critical habitat has been designated for federally listed reptile or amphibian species in Washington; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Fish

All of the federally listed fish species in Washington have federally designated critical habitat. Critical habitat for the bull trout was designated in 30 counties throughout Washington. Critical habitat for the Chinook salmon , chum salmon , Coho salmon, sockeye salmon , and steelhead was designated as all river reaches within evolutionarily significant units accessible to these species in Washington. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water and therefore would not likely disturb critical habitat. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Only one of the federally listed invertebrate species in Washington has federally designated critical habitat. Critical habitat for the Taylor's checkerspot was designated in Thurston County. Land clearing, excavation activities, and other ground disturbing activities in these regions of Washington could lead to habitat loss or degradation, which could affect this invertebrate depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Plants

Of the 11 federally listed plant species in Washington that are endangered or threatened, four of them have federally designated critical habitat. Critical habitat for the Kincaid's lupine was designated in Lewis County. Critical habitat for the Umtanum Desert buckwheat was designated in Benton County. Critical habitat for the Wenatchee Mountains checkermallow was designated in Chelan County. Critical habitat for the white bluffs baldderpod was designated in Franklin County.

Land clearing, excavation activities, and other ground disturbing activities in these regions of Washington could lead to habitat loss or degradation, which affect these plants depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential effects to threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Effect

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no effect on threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be 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 on threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened and endangered because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact protected species, it is anticipated that this activity would have no impact on protected species.

Activities with the Potential to Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality, reproductive effects, and behavioral changes. 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. mollusks, small mammals, and young). Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, or behavioral changes if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, or behavioral changes.
  - 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, or behavioral changes. 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 or near bodies of water and construction of landings and/or facilities on the shores or the banks of waterbodies that accept the submarine cables could potentially impact threatened and endangered species and their habitat, particularly aquatic species (see Section 8.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, and if activities occurred during critical 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 and behavioral changes 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, or behavioral changes. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are required, impacts could be similar to new wireless construction. Hazards related security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, or behavioral changes. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts. may affect, but are not likely adversely affect protected species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts.

It is anticipated that operational impacts may affect, but are not likely to adversely affect, threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect, threatened and endangered species, as they would be conducted infrequently, and BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. FirstNet would attempt to avoid areas where these species are known to occur. Therefore, listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. FirstNet would attempt to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species through direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. FirstNet would attempt to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further minimize potential impacts.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that operational activities are not likely to adversely affect threatened and endangered species, and their habitats as a result of routine operations, management, and monitoring. FirstNet would attempt to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 9, may be implemented as appropriate to further 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 effect on 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 8.1.6.6, Threatened and Endangered Species and Species of Concern.

8.2.7. Land Use, Recreation, and Airspace

8.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Washington associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.7.2. 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 8.2.7-1. As described in Section 8.2, 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 8.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less Than Significant with Mitigation Incorporated	Impact Level: Less Than Significant	Impact Level: No Impact
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception.	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA
Indirect land use change	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses.	Effect that is potentially significant, but with mitigation is less than significant.	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses.	No conflicts with adjacent existing or planned land uses.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities.	Effect that is potentially significant, but with mitigation is less than significant.	Restricted access to recreation land or activities.	No disruption or loss of access to recreational lands or activities.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites.	Effect that is potentially significant, but with mitigation is less than significant.	Small reductions in visitation or duration of recreational activity.	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less Than Significant with Mitigation Incorporated	Less Than Significant	No Impact
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace.	Effect that is potentially significant, but with mitigation is less than significant.	Alteration to airspace usage is minimal.	No alterations in airspace usage or flight patterns.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Airspace altered indefinitely.		Short-Term: Airspace altered for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

8.2.7.3. 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 ROWs or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the 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 8.2.7-1, 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 ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 8.2.7-1, less than significant impacts would be anticipated as any new land use would be small-scale; only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

The deployment, operation, and maintenance of facilities and the acquisition of ROW or easement could influence access to public or private recreation land or activities. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features. In the long-term, the deployment and installation of poles, towers, structures, or other aboveground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 8.2.7-1, 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. Crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features could temporarily impact enjoyment of recreation land. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 8.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: If aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Potential impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could, but are not likely to, obstruct navigable airspace in Washington.

Based on impact significance criteria presented in Table 8.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. As drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period, FirstNet would not have a significant impact airspace resources.

8.2.7.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure, and the specific deployment requirements, some activities would result in potential impacts to land use, recreation, and airspace resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: See Activities with the Potential to Have Impacts below.
    - Recreation: See Activities with the Potential to Have Impacts below.
    - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace (See Section 8.1.7.5 Obstructions to Airspace Considerations).
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: See Activities with the Potential to Have Impacts below.
    - Airspace: It is anticipated that there would be no impacts to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace(See Section 8.1.7.5 Obstructions to Airspace Considerations).
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.

    - Land Use: See Activities with the Potential to Have Impacts below.
    - Recreation: See Activities with the Potential to Have Impacts below.
    - Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
    - Airspace: No impacts are anticipated to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
    - Airspace: Lighting of dark fiber would have no impacts to airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
    - Land Use: See Activities with the Potential to Have Impacts below.
    - Recreation: See Activities with the Potential to Have Impacts below.
    - Airspace: The installation of cables in limited nearshore and inland bodies of water and construction of landings/facilities would not impact flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 8.1.7.5 Obstructions to Airspace Considerations).
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
    - Land Use: See Activities with the Potential to Have Impacts below.
    - Recreation: See Activities with the Potential to Have Impacts below.
    - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review

based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 8.1.7.5 Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See Activities with the Potential to Have Impacts below.
    - Airspace: See Activities with the Potential to Have Impacts below.
- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: No impacts to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
    - Airspace: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet above ground level or do not trigger any of the other FAA obstruction to airspace criteria.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed but would not restrict access to, or enjoyment of, recreational lands.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact airspace because those activities would not result in changes to flight patterns and airspace usage or result in obstructions to airspace.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact to land use, recreation, or airspace, it is anticipated that this activity would have no impact on land use, recreation, or airspace.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to land use, recreation resources, or airspace as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed ROWs or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on 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.

o 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

o 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 above ground level or meets other criteria. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight patterns of an airport if the aerial fiber optic plant is located in proximity to one of Washington's airports.

o 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 Washington airports (See obstruction criteria in Section 8.1.7.5 Obstructions to Airspace Considerations). Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, untethered balloons, and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
        - Land Use: No impacts are anticipated – see previous section
        - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
        - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities. Potential impacts to land uses associated with deployment could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace could include obstructions. These potential impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Additionally FirstNet (or its network partners), would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections because there would be no ground disturbance, no airspace activity, and no access restrictions to recreational lands. If routine maintenance or inspection activities would conflict with existing or surrounding land uses, impact recreation resources, or conflict with airspace, impacts could result as explained above.

Operation of the Deployable Technologies options of the Preferred Alternative could result in the temporary presence of deployable vehicles and equipment (including airborne equipment), potentially for up to two years in some cases. Operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections, assuming that the same access roads used for deployment are also used for inspections.

The degree of change in the visual environment (see Section 8.2.8, Visual Resources)—and therefore the potential indirect impact on a landowner's ability to use or sell of their land as desired—would be highly dependent on the specific deployment location and length of deployment. Once deployment locations are known, the location would be subject to an environmental review to help ensure environmental concerns are identified. The use of deployable aerial communications architecture could temporarily add new air traffic or aerial navigation hazards. The magnitude of these effects would depend on the specific location of airborne resources along with the duration of their use. FirstNet would coordinate with the FAA to review required certifications. Chapter 9, 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.

8.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected, however, impacts would be less than significant due to the temporary nature of likely deployment activities. If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, Firstnet (or its partners) would consult with the FAA to determine how to proceed. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall, these potential impacts would be less than significant due to the temporary nature of deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 8.1.7, Land Use, Recreation, and Airspace.

8.2.8. Visual Resources

8.2.8.1. Introduction

This section describes potential impacts to visual resources in Washington associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 8.2.8-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to visual resources addressed in this section are presented as a range of possible impacts.

Table 8.2.8-1: Impact Significance Rating Criteria for Visual Resources

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
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.

8.2.8.3. 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 Washington, residents and visitors travel to many national monuments, historic sites, and state parks, such as Mount Rainier National Park, to view its scenic vistas and hiking opportunities. If lands considered visually significant or scenic were subject to vegetation loss or removal, short- or long-term effects to viewsheds or scenic resources could occur. Bare ground or interruption of a landscape due to vegetation removal could be considered an adverse change in the aesthetic character of scenic resources or viewsheds. New towers or structures constructed within scenic areas could disrupt the perceived aesthetic character or scenery of an area. If new towers were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Based on the impact significance criteria presented in Table 8.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered potentially significant if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. Given the small-scale of likely FirstNet activities, impacts are expected to be less than significant.

Nighttime Lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility that caused regional impacts or permanent changes to night sky conditions, those effects could be considered potentially significant.

Based on the impact significance criteria presented in Table 8.2.8 1, lighting that illuminates the night sky, diminishes night sky viewing over long distances, and persists over the long-term could be considered potentially significant. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience potentially significant impacts to night skies, although potentially minimized to less than significant with implementation of BMPs and mitigation measures, as defined in Chapter 9, BMPs and Mitigation Measures. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented.

8.2.8.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to visual resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve minimal new nighttime lighting and pole replacement would be limited.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lighting.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to visual resources because there would be no ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact on visual resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to visual resources. The degree of impact would depend on the timing, location, and type of project; installation of a hut or POP would be permanent, whereas ground-disturbing activities would be short-term. In most cases, development located next to existing roadways would not affect visual resources unless vegetation were removed or excavation occurred in scenic areas.
  - New Build – Aerial Fiber Optic Plant: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public rights-of-ways would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in

areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units are needed, 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. As discussed above, potential impacts to night skies from lighting are expected to be less than significant with BMPs and mitigation measures incorporated. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park 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. Chapter 9, 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.

8.2.8.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be less than significant as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to visual resources associated with routine inspections 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 given the limited geographic scope for individual activities. . Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to visual resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 8.1.8, Visual Resources.

8.2.9. Socioeconomics

8.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Washington associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 8.2.9-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to socioeconomics addressed in this section are presented as a range of possible impacts.

Table 8.2.9-1: 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 spending, income, industries, and public revenues.
	Geographic Extent	Regional impacts observed throughout the state/ territory.		Effects realized at one or multiple isolated cities/towns.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Impacts to employment	Magnitude or Intensity	High level of job creation at the state or territory level.	Effect that is potentially significant, but with mitigation is less than significant.	Low level of job creation at the state/territory level.	No job creation due to project activities at the state/territory level.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated cities/towns.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than significant with mitigation 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

8.2.9.3. Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts related to Changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values due to below average public safety communication services. Improved services would reduce response times and improve responses (provide a better fit of the response to the need). These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Affected Environment, property values vary considerably across Washington. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $325,000 in the Seattle area, to approximately $160,000 in the Yakima 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 Spending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and partner(s) make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's partner(s) may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

FirstNet may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment could be a minor, direct, beneficial impact of expenditures on FirstNet. Additional, indirect employment increases would occur as additional businesses hire workers to provide supporting goods and services. For instance, FirstNet contractors and their subcontractors and vendors would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and less than significant. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across Washington. The average unemployment rate in 2014 was 6.2 percent, matching the national rate. County-level unemployment rates were higher than the national rate in all but six counties. Counties with the lowest unemployment rates (better economic performance) were located around the Seattle area and in the southeastern part of the state, and counties with the highest rates generally were located in the southwestern and northeastern parts 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 8.2.9-1 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.

8.2.9.4. 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 8.1.2, 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 8.2.9-1. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

- Satellites and Other Technologies
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact socioeconomics, it is anticipated that this activity would have no impact on socioeconomic resources.

Activities with the Potential to Have Impacts

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below summarizes how the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate;
- Changes to Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting

of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:

- Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment through existing or new boxes or huts would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities and would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Aerial Fiber Optic Plant: Pole/structure installation would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor

for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus, the impacts would be less than significant.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property

values. This is because such facilities may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant.

        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

In general, the abovementioned activities would have less than significant beneficial socioeconomic impacts. 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. 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. Chapter 9, 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.

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 8.1.2, 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. Public or private sector employees would conduct all operational activities, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity, and not significant across the entire state, they are measurable socioeconomic impacts.

Potential socioeconomic impacts would primarily be beneficial, and generally of these types:

- Changes to Spending, Income, Industries, and Public Revenues – Operational activities would require expenditures, which then generate business income and employee wages, and may result in new public sector revenues such as taxes on sales and income. All such effects would be small in scale relative to the regional and state economy; their impacts would be less than significant.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply potential concerns 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 Washington. Chapter 9, 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.

8.2.9.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, all deployment activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, such as generation of business income and employee wages, and creation or sustainment of jobs. The impacts would be small for each activity and therefore less than significant.

Deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, would require storage, staging, and launch/landing areas. Development or enlargement of these facilities could have adverse impacts on nearby property values. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be implemented in greater numbers and over a larger geographic extent. These potential impacts are anticipated to be less than significant as described above. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be less than significant at the programmatic level.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be less than significant as they would be limited to a relatively small number of sites within the region and state. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated deployment or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to socioeconomics from deployment and operation of the No Action Alternative. Socioeconomic conditions would therefore be the same as those described in Section 8.1.9, Socioeconomics.

8.2.10. Environmental Justice

8.2.10.1. Introduction

This section describes potential impacts to environmental justice in Washington associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 8.2.10-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to environmental justice addressed in this section are presented as a range of possible impacts.

Table 8.2.10-1: 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

8.2.10.3. Description of Environmental Concerns

Effects Associated with Other Resource Areas That Have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment." (CEQ, 1997) Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. Indian tribes are considered environmental justice populations (CEQ, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both* "adverse" and "disproportionately high" in their incidence on environmental justice populations relative to the general population (CEQ, 1997). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences (Section 8.2.9).

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 8.1.10.4) as having moderate potential or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 8.1.10.3, Environmental Setting:

Minority and Low-Income Populations, Washington has a lower percentage of its population in the All Minorities category, and a lower poverty rate, than the region or the nation. Nonetheless, Washington has many areas with high potential for environmental justice populations. The areas with high potential and moderate potential for environmental justice populations are evenly distributed across Washington. They occur within the largest population concentrations and in the sparsely populated regions of the state. Further analysis using the data developed for the screening analysis in Section 8.1.10.4, Environmental Justice Screening Results, may be useful. In addition, USEPA's EJSCREEN tool and USEPA's lists of environmental justice grant and cooperative agreement recipients may help identify local environmental justice populations (USEPA, 2015e; USEPA, 2014c).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts could use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

8.2.10.4. 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand holes, pulling vaults, junction boxes, huts, and POP structures. Activities at these small entry points would be limited and temporary and thus are not likely to produce perceptible changes affecting any surrounding communities. Therefore, they would not affect environmental justice communities.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and therefore would have no impacts to environmental justice. If physical access were required to light dark fiber, it would likely be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts on environmental justice communities.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance, impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice, it is anticipated that this activity would have no impact on environmental justice.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures. These activities could temporarily generate noise and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Aerial Fiber Optic Plant: Pole/structure installation could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore or the banks of waterbodies that accept submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered

environmental justice impacts.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise, and dust could be temporarily generated, and traffic could be temporarily 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. It is anticipated that such activities would not result in environmental justice impacts, as the intensity of these activities would be low (low potential for objectionable effects such as noise and dust) and their duration would be very short. Routine maintenance and inspection would not adversely affect property values, for the same reasons. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment activities that involve construction.

Impacts are expected to be less than significant given the short-term nature and limited geographic scope for individual activities. Chapter 9, 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.

8.2.10.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise, and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant because they would be temporary in nature. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) that could negatively affect the value of surrounding properties. In addition, equipment maintenance activities at such facilities may temporarily generate noise, and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant as operations are expected to be temporary in nature. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to environmental justice as a result of deployment and operation of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 8.1.10, Environmental Justice.

8.2.11. Cultural Resources

8.2.11.1. Introduction

This section describes potential impacts to cultural resources in Washington associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.11.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 8.2.11-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to cultural resources addressed in this section are presented as a range of possible impacts.

Table 8.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse effect	Mitigated adverse effect[a]	Effect, but not adverse	No effect
Physical damage to and/or destruction of historic properties[b]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
	Geographic Extent	Direct effects APE.		Direct effects APE.	Direct effects APE.
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties.		Permanent direct effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
Indirect effects to historic properties (i.e., visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a contributing or non-contributing portion of a single or many historic properties.	No indirect effects to historic properties.
	Geographic Extent	Indirect effects APE.		Indirect effects APE.	Indirect effects APE.
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties.		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties.	No indirect effects to historic properties.
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct or indirect effects to historic properties.
	Geographic Extent	Direct and/or indirect effects APE.		Direct and/or indirect effects APE.	Direct and/or indirect effects APE.

	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties.		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties.	No direct or indirect effects to historic properties.
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No segregation or loss of access to historic properties.
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties.		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties.	No segregation or loss of access to historic properties.
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties.		Infrequent, temporary, or short-term changes in access to a single or many historic properties.	No segregation or loss of access to historic properties.

[a] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is “Less than Significant with Mitigation Incorporated,” historic properties are considered to be “non-renewable resources,” given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/THPO and other consulting parties, including Indian Tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[b] Per NHPA, a “historic property” is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project’s APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian Tribes and other consulting parties that, in consultation with the respective party (ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

8.2.11.3. 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 8.2.11-1, direct deployment impacts could be potentially significant if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given archaeological sites and historic properties are present throughout Washington, some deployment activities may be in these areas, in which case BMPs (see Chapter 9) 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 could be avoided or minimized through BMPs (see Chapter 9).

Loss of Access to Historic Properties

The deployment of equipment requiring a secure area has the potential to cause the loss of access to historic properties. The highest potential for this type of significant impact would be from the deployment of equipment in secure areas that impact the access to sites of cultural importance to American Indians. It is anticipated that FirstNet would identify potential impacts to such areas by conducting research on particular areas and through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

8.2.11.4. 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to cultural. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
    - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties within Washington.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could impact cultural resources, as coastal areas, shorelines and creek banks in Washington have the potential to contain prehistoric archaeological sites, as well as sites associated with the state's significant maritime history since European colonization, such as shipwrecks. Impacts to cultural resources could also potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cable, which could result in the disturbance of archaeological and historical sites (archaeological deposits are frequently associated with bodies of water, and Washington has numerous maritime and riverine archaeological sites associated with its 19th century commercial expansion), and the associated network structures could have visual effects on historic properties.
    - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
    - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
    - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in the disturbance of archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas, such as Seattle, that have larger numbers of historic public buildings.
    - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment site. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties; however, due to the small scale of expected activities, these actions could affect, but would not likely adversely affect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 9, 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.

8.2.11.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse effects to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be no effects to cultural resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur, however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to cultural resources as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 8.1.11, Cultural Resources.

8.2.12. Air Quality

8.2.12.1. Introduction

This section describes potential impacts to Washington's air quality from deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Washington's air quality were evaluated using the significance criteria presented in Table 8.2.12-1. As described in Section 8.2, 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 Washington's air quality addressed in this section are presented as a range of possible impacts.

Table 8.2.12-1: Impact Significance Rating Criteria for Washington

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

8.2.12.3. Description of Environmental Concerns

Increased Air Emissions

The Proposed Action has the potential to generate air pollutant emissions. These emissions could be above and beyond what is typically generated in a given area and may alter ambient air quality. Deployment activities may involve the use of vehicles, heavy equipment, and other equipment that could emit exhaust and create fugitive dust in localized areas. During operations, routine maintenance and other use of generators at tower facilities may emit exhaust for specific durations (maintenance) or unpredictable timeframes (if power is lost to a site, for example). Impacts are likely to be less than significant due to the mobile nature of the sources and the temporary and short-term duration of deployment activities. Although unlikely, the emissions of criteria pollutants could impair the air quality of the region and potentially affect human health. Potential impacts to air quality from emissions may occur in areas where the current air quality exceeds, or has a history of exceeding, one or more NAAQS. Areas exist in Washington that are in maintenance for one or more criteria pollutants including CO, PM_{10} and $PM_{2.5}$ (see Section 8.1.12, Air Quality).

Based on the significance criteria presented in Table 8.2.12-1, air emission impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of emission sources be deployed/operated long-term in the same area from fixed or mobile sources or construction activities. Less than significant emissions could occur for any of the criteria pollutants within attainment areas in Washington; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present throughout Washington Figure 8.1.12-1, 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.

8.2.12.4. Potential Impacts of the Preferred Alternative

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

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points, however, this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create minimal new sources of emissions.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to no impact on ambient air quality concentrations.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have no impact on those resources.

Activities with Potential Impacts to Air Quality

Construction, deployment, and operation activities related to the Preferred Alternative could impact air quality by generating various quantities of criteria and air pollutant emissions. It is expected that such impacts would be less than significant due to the shorter duration and localized nature of the activities. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in fugitive dust and products of combustion from the use of vehicles and heavy equipment.
  - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment could result in products of combustion from

the use of vehicles and machinery, as well as fugitive dust emissions from site preparation.

- Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in products of combustion from the use of vehicles and heavy equipment, as well as fugitive dust from site preparation.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could generate products of combustion from vessels used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If additional power units, structural hardening, and physical security measures require grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
  - Deployable Technologies: The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be less than significant due to the limited nature of the deployment. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be less than significant impacts to air quality 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. Chapter 9, 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.

8.2.12.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows.

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight except for balloons. The products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations, would dictate the concentrations and associated impacts. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

8.2.13. Noise

8.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and Alternatives in Washington. Chapter 9, 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.

8.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 8.2.13-1. As described in Section 8.2, 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 Washington addressed in this section are presented as a range of possible impacts.

Table 8.2.13-1: Impact Significance Rating Criteria for Noise

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than significant with BMPs and mitigation measures incorporated**	**Less than significant**	**No impact**
Increased noise levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific state noise limits. Noise levels plus baseline noise levels would exceeds 10 dBA increase from baseline noise levels (i.e., louder). Project noise levels near noise receptors at National Parks would exceed 65 dBA.	Effect that is potentially significant, but with mitigation is less than significant.	Noise levels resulting from project activities would exceed natural sounds, but would not exceed typical noise levels from construction equipment or generators.	Natural sounds would prevail. Noise generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.
	Geographic Extent/Context	County or local.		County or local.	County or local.
	Duration or Frequency	Permanent or long-term.		Short term.	Temporary.

8.2.13.3. Description of Environmental Concerns

Increased Noise Levels

The Proposed Action has the potential to generate noise during construction and operation of various equipment used for deployment. These noise levels could be above what is typically generated in a given area and may alter the ambient acoustical environment. If significant, the noise could cause impacts on residential areas, or other facilities that are sensitive to noise, such as churches, hospitals, or schools. The construction activities for deploying some of the various equipment evaluated under the Proposed Action could cause short-term impacts to nearby populations. However, it is likely that there would be less long-term effects from operational use of the proposed equipment (see Section 8.1.13, Noise).

Based on the significance criteria presented in Table 8.2.13-1, noise impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of noise sources be deployed/operated long-term in the same area. Noise levels from deployment activities are not expected to exceed typical noise levels for short-term/temporary construction equipment or generators.

To the extent practicable, FirstNet would attempt to mitigate or minimize noise effects during construction or operation. BMPs and mitigation measures could help to limit impacts on nearby noise-sensitive receptors. However, given that much of the concentration and setup of equipment would often occur in populated areas, FirstNet operations would not be able to completely avoid noise impacts due to construction and operations at various receptors.

8.2.13.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1, Proposed Action, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise impacts and while others would not. In addition, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
    - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in high noise levels from the use of heavy equipment and machinery.
    - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment would be short-term and could result in

increased noise levels from the use of vehicles and machinery.

- Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in noise levels from the use of heavy equipment and machinery.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise levels if the activity required the use of heavy equipment for grading or other purposes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could generate noise if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shores or the banks of waterbodies that accept submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. These impacts are expected to be less than significant due to the temporary duration of deployment activities. Additionally, pre-existing noise levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be less than significant and similar to several of the deployment activities related to routine maintenance and inspection of the facilities because of the temporary nature of the activities, which would not create new permanent sources of noise. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be similar to or less than those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections or onsite generator use occurs, potential noise impacts could result as explained above. Chapter 9, 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.

8.2.13.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations and the duration of deployment. The potential noise impacts are as follows.

Deployment Impacts

Implementing deployable technologies could result in noise from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise levels. Several vehicles traveling together could also create short-term noise impacts on residences or other noise-sensitive receptors as they pass by. With the exception of balloons, the deployment of aerial technology is anticipated to generate noise during all phases of flight. Aerial technologies would have the highest level of noise impact if they are required to fly above residential areas, areas with a high concentration of noise-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Deployable Technologies Alternative would be similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Operation of generators could also generate noise in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise impacts could be minimal in those areas. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise impacts could result as explained above.

Operational impacts from aerial technologies would include repeated flyovers by UAS vehicles while they are needed in the area. This could generate less than significant short-term impacts on any residential areas or other noise-sensitive receptors under the flight path of these vehicles. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

8.2.14. Climate Change

8.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Washington associated with deployment and operation of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.14.2. 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 8.2.14-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to climate and climate change-vulnerable resources addressed in this section are presented as a range of possible impacts.

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or alternatives. The second is related to the implications and possible effects of climate change on the environmental consequences of the Proposed Action or alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or alternatives (CEQ, 2014).

CEQ has established the significance criteria for GHG emissions at 25,000 MT CO_2e on an annual basis, with the requirement that if projected emissions exceed this threshold, a GHG emissions quantitative analysis is warranted (CEQ, 2014). Although 25,000 MT is a very small fraction (one 266,920th) of the total U.S. emissions of 6,673 MMT CO_2e in 2013 (USEPA, 2015r), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the proposed action is more general. In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2014). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process could provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 8.2.14-1: Impact Significance Rating Criteria for Climate Change

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less Than Significant with Mitigation Measures Incorporated	Less Than Significant	No Impact
Contribution to climate change through GHG emissions	Magnitude or Intensity	Exceedance of 25,000 metric tons of CO_2e/year, and global level effects observed.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No increase in greenhouse gas emissions or related changes to the climate as a result of project activities.
	Geographic Extent	Global impacts observed.		Global impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No measurable impact of climate change on FirstNet installations or infrastructure.
	Geographic Extent	Local and regional impacts observed.		Local and regional impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA

NA = Not Applicable

8.2.14.3. Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. An increase in average annual temperature of 3.3 °F to 9.7 °F is projected by 2070 to 2099 (compared to the period 1970 to 1999), depending largely on a low or high emissions scenario. The increases are projected to be largest in summer. (USGCRP, 2014a)

Additionally, the Northwest is projected to observe a longer frost-free season by mid-century as compared to a 1971 – 2000 baseline, where a frost-free season is defined as the period between the last occurrence of 32 °F in the spring and the first occurrence of 32 °F in the fall. In Idaho, the frost-free season under a high emissions scenario is expected to extend greater than 80 days longer than the baseline years in much of the state. (USGCRP, 2014b)

Air Temperature

Figure 8.2.14-1 and Figure 8.2.14-2 illustrate the anticipated temperature changes for low and high GHG emissions scenarios for Washington from a 1969 to 1971 baseline.

Figure 8.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the Bsk region of Washington under a low emissions scenario would increase by approximately 4 °F, and by the end of the century (2080 to 2099) under a low emissions scenario temperatures in the Bsk region of Washington would increase by approximately 5 °F.

Figure 8.2.14-2 shows that under a high emissions scenario for the period (2040 to 2059), temperatures would increase by approximately 4 °F. Under a high emissions scenario for the period (2080 to 2099) in the Bsk region of Washington, temperatures would increase by approximately 8 °F. (USGCRP, 2009)

Cfa **–** Under a low emissions scenario temperatures in the Cfa region of Washington are expected to increase by approximately 3 °F on the west coast of the state and 4 °F in the remainder of the region by mid-century. By the end of the century, temperatures are projected to increase 4 °F or 5 °F depending on the portion of the region. (USGCRP, 2009)

Under a high emissions scenario temperatures in the Cfa region of Washington are projected to increase by approximately 3 °F or 4 °F depending on the portion of the region by mid-century. By the end of the century temperatures in the coastal portion of the Cfa region are projected to increase 6 °F, with expected increases 7 °F or 8 °F for the remainder of the region. (USGCRP, 2009)

Csb **–** Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Cfa region under both low and high emissions scenarios. (USGCRP, 2009)

Dfb **–** Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Bsk region under both low and high emissions scenarios. (USGCRP, 2009)

Dsb – Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Bsk and Dfb regions under both low and high emissions scenarios. (USGCRP, 2009)

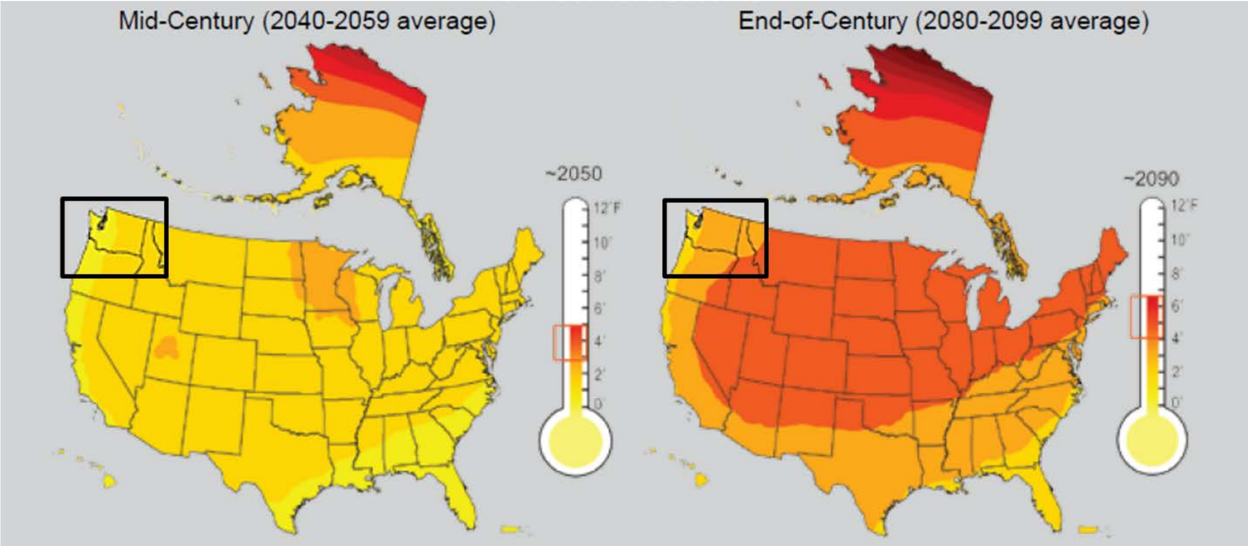


Figure 8.2.14-1: Washington Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

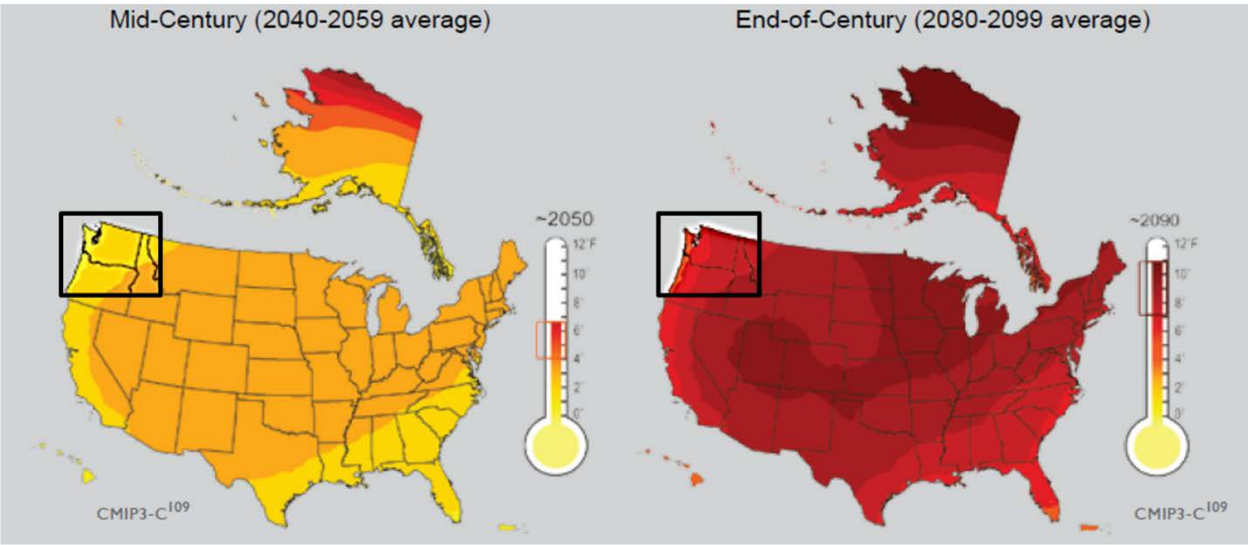


Figure 8.2.14-2: Washington High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

Precipitation

Under a high emissions scenario, summer precipitation is projected to decrease by as much as 30 percent by the end of the century in the Northwest. (USGCRP, 2014a) "Northwest summers are already dry and although a 10 percent reduction (the average projected change for summer) is a small amount of precipitation, unusually dry summers have many noticeable consequences, including low streamflow west of the Cascades and greater extent of wildfires throughout the region (USGCRP, 2014a)."

In Washington, there is an expected increase of about 10 percent in the number of consecutive dry days under a low emissions scenarios by mid-century (2041 to 2070) as compared to the period 1971 to 2000. Under a high emissions scenario in the majority of the state, there is a projected increase of about 30 percent in the number of consecutive dry days. An increase in consecutive dry days could lead to drought. (USGCRP, 2014c)

Figure 8.2.14-3 and Figure 8.2.14-4 show predicted seasonal precipitation change for an approximate 30-year period of 2071 to 2099 compared to a 1970 to 1999 approximate 30-year baseline. Figure 8.2.14-3 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050. (USGCRP, 2014c)

Figure 8.2.14-3 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. (Note: white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability.) (USGCRP, 2014c)

Bsk – Figure 8.2.14-3 shows that in a low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent in winter and spring in the Bsk region of Washington. However, there are no expected changes in precipitation in summer other than fluctuations due to natural variability. Fall precipitation is expected to remain constant or increase 10 percent depending on the portion of the region. (USGCRP, 2014c)

Figure 8.2.14-4 shows that if emissions continue to increase, winter precipitation could increase by as much as 20 percent over the period 2071 to 2099. In spring, precipitation in this scenario could increase 10 or 20 percent depending on the portion of the region. Summer precipitation is expected to decrease 20 percent. Fall precipitation is expected to increase 10 percent. (USGCRP, 2014c)

Cfa – Under a low emissions scenario precipitation in the Cfa region will increase 10 percent in winter and spring. There are no anticipated changes to summer or fall precipitation. (USGCRP, 2014c)

Under a high emissions scenario precipitation in the Cfa region is projected to increase 20 percent in winter and decrease 20 or 30 percent in summer depending on the portion of the region. In spring, precipitation will remain constant or increase 10 percent depending on the portion of the region. Fall precipitation will increase 10 or 20 percent depending on the portion of the region. (USGCRP, 2014c)

Csb – In the Csb region, winter precipitation is anticipated to increase 10 percent under a low emissions scenario. Spring and fall precipitation will remain constant or increase 10 percent depending on the portion of the region. There are no anticipated changes to summer precipitation other than due to natural variability. (USGCRP, 2014c)

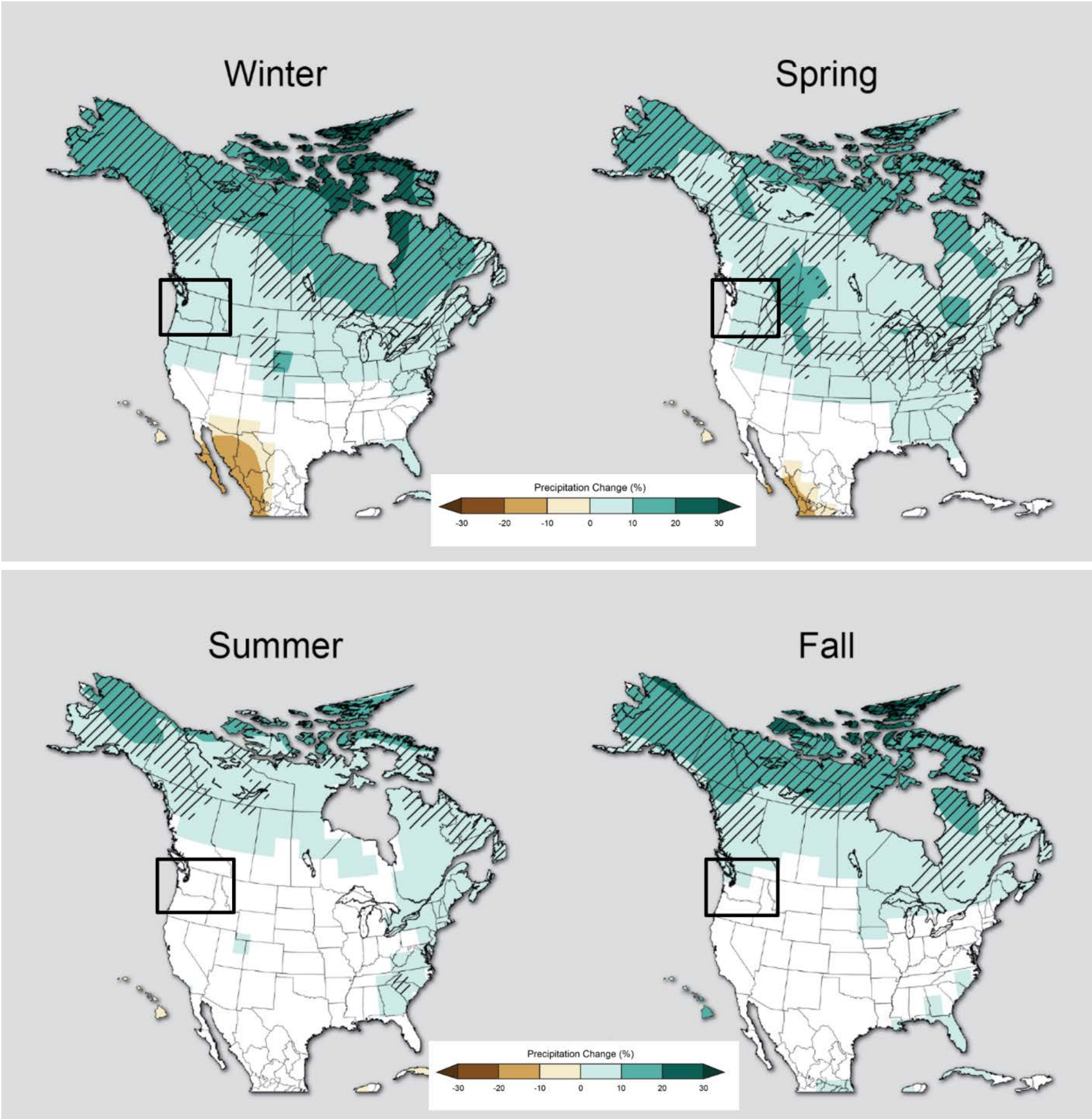


Figure 8.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014c)

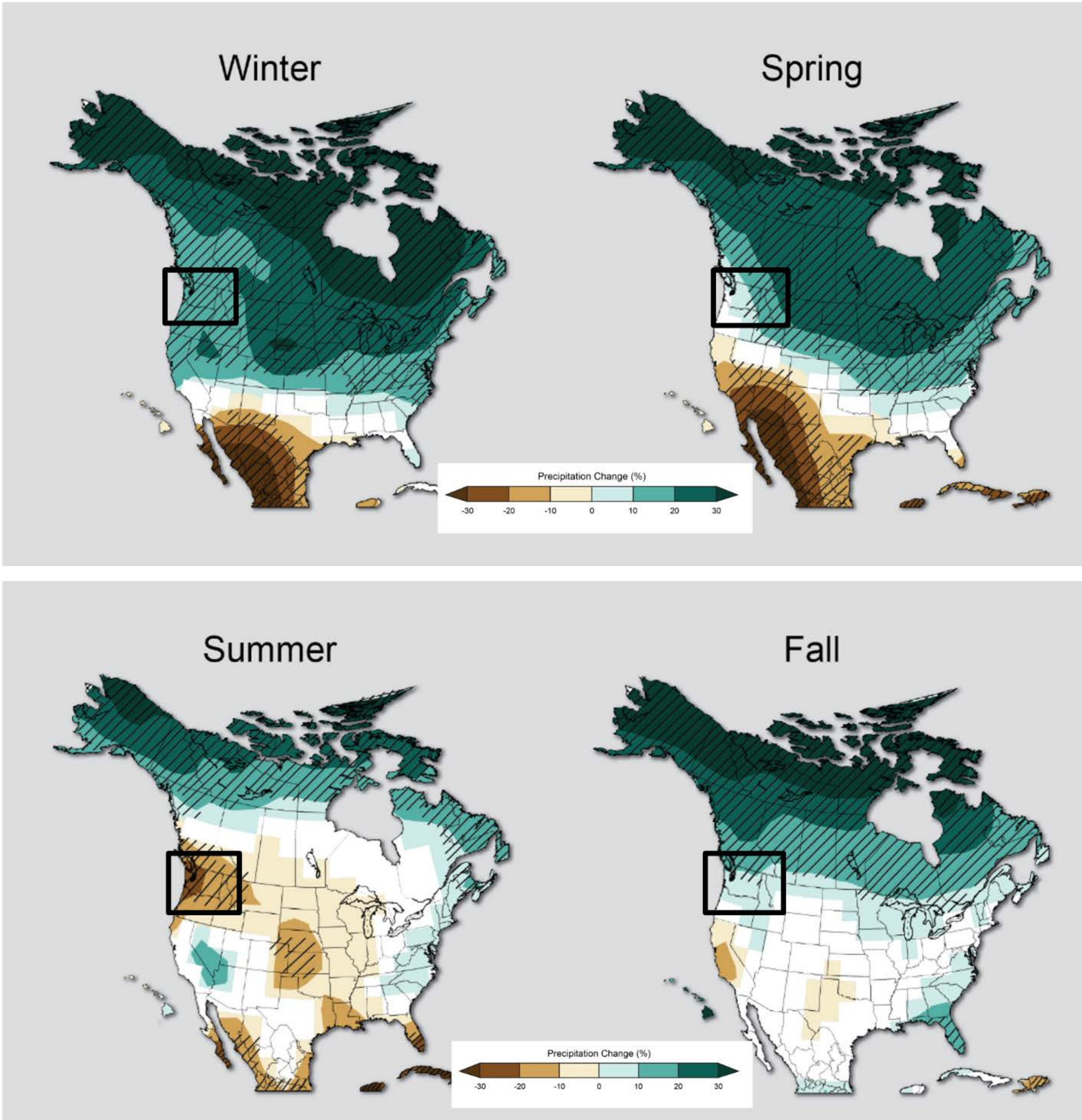


Figure 8.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2014c)

Under a high emissions scenario precipitation will increase 20 percent in winter. During the spring in the Csb region of Washington, precipitation will remain constant, increase 10 percent or increase 20 percent depending on the portion of the region. Summer precipitation is expected to decrease 30 in the western most portion of the region or 20 percent in the remainder of the region. Fall precipitation is expected to increase 10 percent. (USGCRP, 2014c)

Dfb – Under a low emissions scenario winter precipitation is expected to increase 10 percent in the Dfb region of Washington. In spring and fall, precipitation is expected to remain constant or increase 10 percent depending on the portion of the region. There are no anticipated changes to summer precipitation. (USGCRP, 2014c)

Under a high emissions scenario winter precipitation is expected to increase 20 percent and summer precipitation is expected to decrease 20 percent. In spring and fall, precipitation will increase 10 or 20 percent depending on the portion of the region. (USGCRP, 2014c)

Dsb – Under a low emissions scenario, precipitation is expected to increase 10 percent in winter and spring in the Dsb region. There are no anticipated changes to summer precipitation. Fall precipitation will remain constant or increase 10 percent depending on the portion of the region. (USGCRP, 2014c)

Winter precipitation will increase 20 percent under a high emissions scenario in the Dsb region of Washington. Spring precipitation is expected to increase 10 or 20 percent depending on the portion of the region. In summer, precipitation will decrease 20 percent in the eastern portion of the region and decrease 30 percent in the western portion of the region. Fall precipitation is expected to increase 10 or 20 percent depending on the portion of the region. (USGCRP, 2014c)

Sea Level

Several factors would continue to affect sea level rise in the future. Glacier melt adds water to the ocean, and increasing ocean temperatures result in thermal expansion. Worldwide, "glaciers have generally shrunk since the 1960s, and the rate at which glaciers are melting has accelerated over the last decade. The loss of ice from glaciers has contributed to the observed rise in sea level" (USEPA, 2012c). When water warms, it also expands, which contributes to sea level rise in the world's oceans. "Several studies have shown that the amount of heat stored in the ocean has increased substantially since the 1950s" (USEPA, 2012c). "Ocean heat content also influences sea level and currents" (USEPA, 2012c).

The amount of sea level rise would vary in the future along different stretches of the U.S. coastline and under different absolute global sea level rise scenarios. Variation in sea level rise along different stretches of coast is mostly due to varying rates of land subsidence (also known as relative sea level rise). Sea level rise scenarios are reported in the National Climate Assessment. These scenarios were developed based on varying degrees of ocean warming and ice sheet loss as estimated by organizations like IPCC (NOAA, 2012b). Figure 8.2.14-5 and Figure 8.2.14-6 show feet of sea level above 1992 levels at different tide gauge stations. Figure 8.2.14-5 shows an 8 inch global sea level rise above 1992 levels by 2050 and Figure 8.2.14-6 shows a 1.24 foot global sea level rise above 1992 levels by 2050 (USGCRP, 2014d).

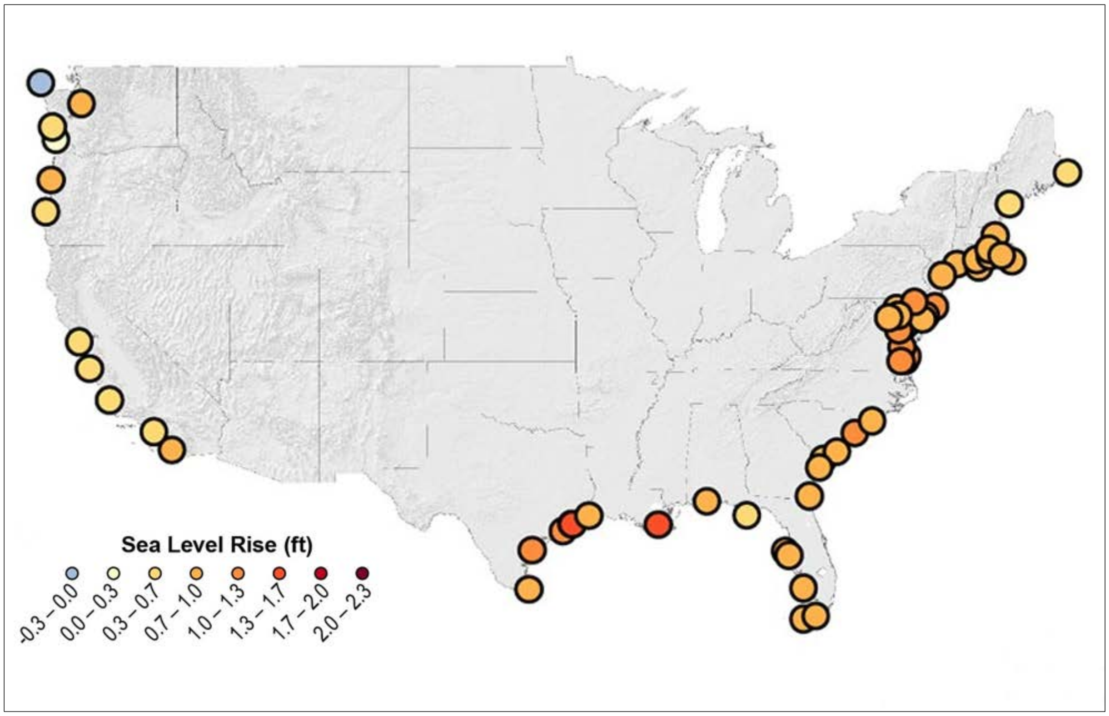


Figure 8.2.14-5: 8-inch Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014d)

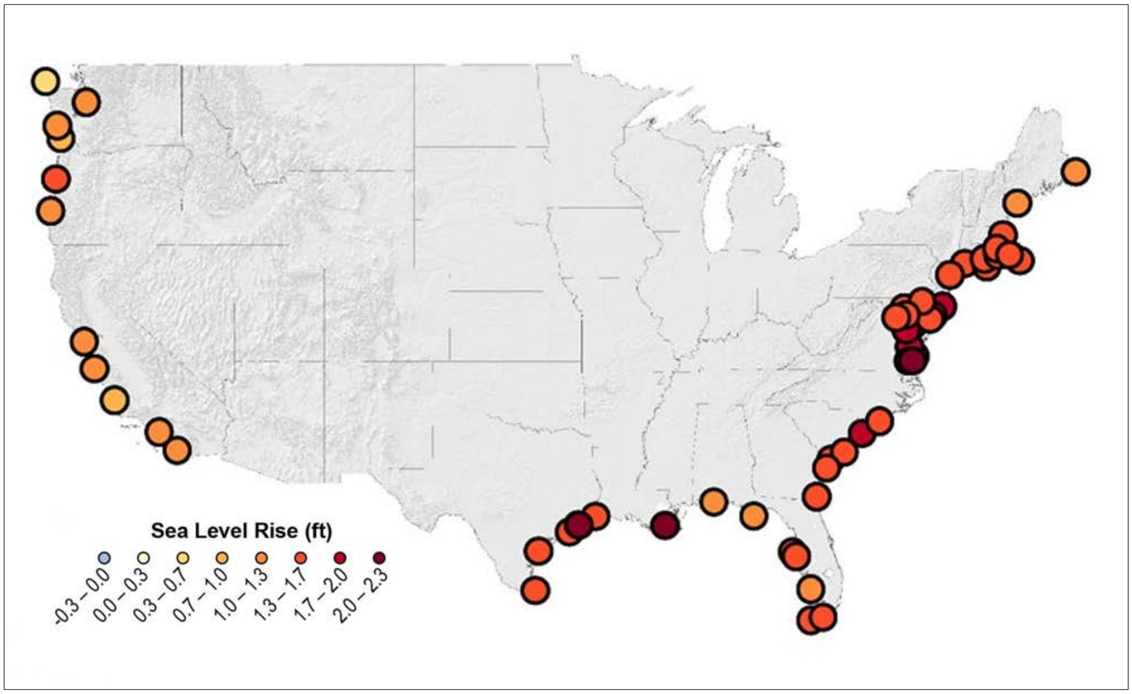


Figure 8.2.14-6: 1.24-foot Sea Level Rise Above 1992 Levels by 2050

Source: (USGCRP, 2014d)

Cfa – Figure 8.2.14-5 presents an 8-inch global average sea level rise above 1992 levels, would result in a 0.03 to 1.0-foot sea level rise in 2050 along the coast of Washington. Figure 8.2.14-6 indicates that a 1.24-foot sea level rise above 1992 levels would result in a 0.07 to 1.3 foot sea level rise in 2050 along the coast of Washington. (USGCRP, 2014d)

Csb – An 8-inch global average sea level rise above 1992 levels would result in sea level rise up to .07 feet in 2050 along the coast of Washington in the Csb region. A 1.24-foot sea level rise above 1992 levels would result in sea level rise up to 1.3 feet by 2050 on the coast of Washington. (USGCRP, 2014d)

Bsk, Dfb, and Dsb – These Washington regions are not affected by sea level rise. (USGCRP, 2014d)

Severe Weather Events

It is difficult to forecast the impact of climate change on severe weather events such as thunderstorms and hurricanes. Trends in thunderstorms and hurricanes are subject to greater uncertainties than trends in temperature and associated variables directly related to temperature such as sea level rise. Climate scientists are studying the influences of climate change on severe storms such as hurricanes. Recent research has yielded insights into the connections between warming and factors that cause severe storms. For example, atmospheric instability and increases in wind speed with altitude link warming with tornadoes and thunderstorms. Additionally, research has found a link between warming and conditions favorable for severe thunderstorms. However, more research is required to make definitive links between severe weather events and climate change. (USGCRP, 2014e)

United States coastal waters are expected to experience more intense hurricanes with related increases in wind, rain, and storm surges (but not necessarily an increase in the number of storms that make landfall) (USGCRP, 2014e). Changes in hurricane intensity are difficult to project because there are contradictory effects at work. Warmer oceans increase storm strength with higher winds and increased precipitation. However, changes in wind speed and direction with height are also projected to increase in some regions; this tends to inhibit storm formation and growth. Current research suggests stronger, more rain-producing tropical storms and hurricanes are generally more likely, though such storms may form less frequently; ultimately, more research would provide greater certainty (USGCRP, 2009).

8.2.14.4. 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 8.2.14-1, climate change impacts as a result of GHG emissions could be significant and require a quantitative analysis if FirstNet's deployment of technology was responsible for increased emissions of 25,000 MT/year or more. The GHG emissions resulting from FirstNet activities fall into two categories: short-term and long-term. Short-term emissions could be associated with deployment activities (vehicles and other motorized construction equipment) and would have no long-term or permanent impact on GHG emissions or climate change. Long-term (both temporary and permanent) emission increases could result from operations, including the use of grid-provided electricity by FirstNet equipment such as transmitters and optical fiber, and from the temporary use of portable or onsite electric generators (a less efficient, more carbon-intensive source of electricity), during emergency situations when the electric grid was down, for example after a hurricane.

A single large cell tower would typically require 20-60kW of power to operate (Balshe, 2011). The CO_2 emissions associated with the operation of the tower would depend on whether it was supplied by a stand-alone power source, such as a generator, or from the grid, and whether it was operating at full power on a continuous basis. A standard 60kW 3-phase diesel generator consumes approximately 5.0 gallons of diesel per hour (Diesel Service & Supply, 2016)

Diesel fuel combustion emits 22.38 lbs of CO_2 per gallon (EIA, 2015e). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity is less carbon-intensive, and would generate approximately 240 MT of CO_2 per year for the same equipment, depending on the region of the U.S. where the electricity was generated (USEPA, 2015s). Furthermore, the components of the system would not necessarily all be this large, running all the time, or at full power. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Vereecken, et al., 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Effects of Climate Change on Project-Related Impacts

Climate change may impact project-related effects by magnifying or otherwise altering impacts in other resources areas. Climate change is expected expose areas of Washington to longer and more intense heat waves (USGCRP, 2014f) and an increased number of days above 95º F, which is anticipated to have negative consequences for public health in the form of increased heat-related morbidity and mortality, and also increase the demand for air conditioning (DOH, 2015g). The increased severity and length of droughts is expected to increase in Washington as snow pack is reduced and temperatures rise. This in turn may contribute to more frequent and larger wildland fires as well as increased fuel load in the form of dead trees caused by invasive bark beetles that thrive in stressed forest environments (USGCRP, 2014a) (USFS, 2015g).

Wildland fires present a threat to forest ecosystems and may present a risk to both permanent and mobile installations as well as to first responders themselves (see the next paragraph).

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.

For areas of Washington at risk for flooding, climate change is projected to increase the frequency and severity of torrential downpours, which in turn may increase the potential for flash floods (USGCRP, 2014f). Sea level rise of approximately 24 inches over the next century is expected to magnify the impacts of coastal storms as well as cause significant coastal inundation in low-lying areas (Washington Department of Ecology, 2012b). FirstNet would locate fixed assets out of flood plains, particularly in the coastal zone and other areas that are likely to be inundated or prone to flooding during these extreme weather events.

The increased risk of wildland fires as a result of climate change may present a risk to fixed installations infrastructure (USGCRP, 2014g) (USFS, 2015g). FirstNet will assess permanent sites on a case-by-case basis for wildland fire risk, and consider the risk to mobile sites during the deployment of FirstNet installations during emergency events.

Extended periods of extreme heat may increase general demand on the electric grid, impeding its operation. In addition, with reduced winter snowpack contributing to reservoirs, the ability of Washington’s extensive hydropower operations to meet demand may be reduced (DOE, 2015). FirstNet will consider electric grid vulnerability and ensure installations have sufficient back-up capacity to function effectively and keep equipment cool during power outages.

Based on the impact significance criteria presented in Table 8.2.14-1, climate change effects on FirstNet installations and infrastructure would be significant if they negatively affected the operation of these facilities.

8.2.14.5. 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 Washington, including deployment and operation activities.

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions. This would create no perceptible change in GHG emissions.
- Satellites and Other Technologies
  - Distribution and Use of Satellite-Enabled Devices: The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create any perceptible changes in GHG emissions because they would not create any new emissions sources.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

Activities with the Potential to Have Impacts

The deployment and use of energy-consuming equipment as a result of the implementation of the Preferred Alternative would result in GHG emissions whose significance would vary depending on their power requirements, duration and intensity of use, and number. The types of infrastructure deployment scenarios that could be part of the Preferred Alternative and result in potential impacts to GHG emissions and climate change include the following:

- Wired Projects
  - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
  - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
  - Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities.

  - New Build – Submarine Fiber Optic Plant: The deployment of small workboats 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 it would not occur. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back up), and would depend on their size, number, and the frequency and duration of their use.
- Deployable Technologies
  - COWs, COLTs, SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However, this would be highly dependent on their size, number, and the frequency and duration of their use.
  - Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of manned or unmanned aircraft were used for a sustained period of time (i.e., months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be less than significant due to the limited and localized nature of deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could be potentially significant to less than significant with BMPs and mitigation measures incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. FirstNet installations should be evaluated in the design and planning phase through tiering to this analysis, in the context of their local geography and anticipated climate hazards to ensure they are properly hardened or there is sufficient redundancy to continue operations in a climate-affected environment. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would likely prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

8.2.14.6. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant due to the temporary nature of the operation of deployables. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. These activities are expected to be less than significant due the limited duration of deployment activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

Climate change effects have the most noticeable impacts over a long period. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to GHG emissions or climate as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 8.1.14, Climate Change.

8.2.15. Human Health and Safety

8.2.15.1. Introduction

This section describes potential impacts to human health and safety in Washington associated with deployment of the Proposed Action and Alternatives. Chapter 9, 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.

8.2.15.2. 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 8.2.15-1. As described in Section 8.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to human health and safety addressed in this section are presented as a range of possible impacts.

Table 8.2.15-1: 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. 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 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 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

8.2.15.3. 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 8.2.15-1, occupational injury impacts could be potentially significant if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites.

To protect occupational workers, OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2016c):

- Engineering controls;
- Work practice controls;
- Administrative controls; and then
- 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,[165] chain locks, bollards, storage containers (for storing equipment and chemicals), or signage and caution tape. Other forms of engineering controls could include machinery designed to manipulate the quality of the work environment, such as ventilation blowers. Whenever practical, engineering controls may result in the complete removal of the hazard from the work site, an example of which would be the transport and offsite disposal of hazardous waste or asbestos containing materials.

Work practice controls could be implemented as abiding by specific OSHA industry standards, such as the Confined Space Entry standard (29 CFR 1910.146) or thru the development of employer specific workplace rules and operational practices (OSHA, 2016c). To the extent

[165] Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents. (OSHA, 2016d)

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 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 Proposed Action sites. In addition to HASPs and safety data sheets, 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 (OSHA, 2016c). 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 refers 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.

WDL&I and Washington DOE are authorized by OSHA to administer the state program, which oversees employee safety in all state and local government and private sector workplaces. State or local employees will not perform the FirstNet proposed action and site work. 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 (OSHA, 2015a). Chapter 9, 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.

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 because of underground shaft collapses or seismic shifting. Based on the impact significance criteria presented in Table 8.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties or abandoned mine lands. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination and/or mining activities using federal resources such as the USEPA Cleanups in My Community database and U.S. Department of Interior's Abandoned Mine Lands inventory, through the Washington DOE, or through an equivalent commercial resource.

By screening sites for environmental contamination, mining activities, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination or mining activities, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination (or mine lands) are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is 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 Washington laws in order to protect workers and the 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, WDL&I and Washington DOE 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.

8.2.15.4. 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, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to human health and safety and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant with mitigation, depending on the deployment scenario or site-specific activities. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: the pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to human health and safety because there would be no ground disturbance or heavy equipment used.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact human health and safety resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or

hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water may require 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 shores or the banks of waterbodies that accept the submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and

management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical

generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, RF 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be less than significant impacts to human health and safety associated with routine inspections of the Preferred Alternative, Use of PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 9, 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.

8.2.15.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source were an electrical generator, then there would also likely be a need to manage 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. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to human health and safety associated with routine inspections of the Preferred Alternative. Use of PPE or other mitigation measures may be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. These impacts would be less than significant because of the small-scale of likely FirstNet activities; activities associated would routine maintenance, inspection, and deployment of deployable technologies would be temporary and often of limited duration. Chapter 9, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to human health and safety as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 8.2.15, Human Health and Safety.

ACRONYMS

Acronym	Definition
AAA	Airport Airspace Analysis
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AFB	Air Force Base
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AIRFA	American Indian Religious Freedom Act
AML	Abandoned Mine Lands
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act
ASL	Above Sea Level
ATC	Air Traffic Control
ATO	Air Traffic Organization
BCAA	Benton Clean Air Agency
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
BNSF	Burlington Northern and Santa Fe Railway
CAA	Clean Air Act
CCD	Common Core of Data
CCMP	Comprehensive Conservation and Management Plan
CCR	Consumer Confidence Report
CCS	Center for Climate Strategies
CDC	Center for Disease Control
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Controlled Firing Areas
CFOI	Census for Fatal Occupational Injuries
CGP	Construction General Permit
CIMC	Cleanups in My Community
CIO	Chief Information Officer
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLT	Cell On Light Truck
COW	Cell On Wheels
CRS	Community Rating System
CWA	Clean Water Act
CWCS	Comprehensive Wildlife Conservation Strategy
CWS	Community Water Systems
DAHP	Department of Archaeology and Historic Preservation
DEQ	Department of Environmental Quality
DMV	Department of Motor Vehicles
DNR	Department of Natural Resources
DOE	Department of Energy

Acronym	Definition
DOH	Department of Health
DOJ	Department of Justice
EDACS	Enhanced Digital Access System
EFH	Essential Fish Habitat
EIA	Energy Information Agency
EIS	Environmental Impact Statement
EJSCREEN	Environmental Justice Screening and Mapping Tool
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
ESA	Endangered Species Act
ESU	Evolutionarily Significant Units
FAA	Federal Aviation Administration
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act of 1976
FSDO	Flight Standards District Offices
FSS	Flight Service Station
GAO	Government Accountability Office
GEG	Spokane International Airport
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GMA	Growth Management Act
HAP	Hazardous Air Pollutant
HAPC	Habitat Areas of Particular Concern
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IBA	Important Bird Areas
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
IWIN	Integrated Wireless Network
LBS	Locations-Based Services
LERN	Law Enforcement Radio Network
LID	Low Impact Development
LMR	Land Mobile Radio
LRR	Land Resource Regions
LTE	Long Term Evolution
MBTA	Migratory Bird Treaty Act
MDI	Methylene Diphenyl Diisocyanate
MFWP	Montana Fish, Wildlife, and Parks
MHI	Median Household Income
MLRA	Major Land Resource Areas
MMPA	Marine Mammals Protection Act
MMT	Million Metric Tons
MNHP	Montana Natural Heritage Program

Acronym	Definition
MOA	Military Operation Areas
MSFCA	Magnuson-Stevens Fisheries Conservation Act
MSFCMA	Magnuson Stevens Fishery Conservation And Management Act
MSL	Mean Sea Level
MYA	Million Years Ago
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NASAO	National Association of State Aviation Officials
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NESCA	Nongame and Endangered Species Conservation Act
NFIP	National Flood Insurance Program
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NM	Nautical Miles
NMFS	National Marine Fisheries Service
NNL	National Natural Landmarks
NOAA	National Oceanic and Atmospheric Administration
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
NRC	National Response Center
NRCA	National Resources Conservation Authority
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NTFI	National Task Force On Interoperability
NTNC	Non-Transient Non-Community
NWCAA	Northwest Clean Air Agency
NWI	National Wetlands Inventory
NWP	Nationwide Permit
NWR	National Wildlife Refuges
NWS	National Weather Service
OCIO	Office of the CIO
ODFW	Oregon Department of Fish and Wildlife
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
ORCAA	Olympic Region Clean Air Agency
ORION	Omaha Regional Interop Network
OSHA	Occupational Safety and Health Administration

Acronym	Definition
OTR	Ozone Transport Region
PAB	Palustrine aquatic bed
PADUS	Protected Area Database of the United States
PCN	Preconstruction Notification
PEIS	Programmatic Environmental Impact Statement
PEM	Palustrine Emergent Wetlands
PFO	Palustrine Forested
PGA	Peak Ground Acceleration
PHS	Priority Habitats and Species
POP	Points of Presence
PPE	Personal Protective Equipment
PRNA	Proposed Research Natural Area
PSAP	Public Safety Answering Points
PSCAA	Puget Sound Clean Air Agency
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PSRS	Public Safety Radio System
PSS	Palustrine scrub-shrub
RACOM	Radio Communications
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RF	Radio Frequency
SAA	Sense and Avoid
SASP	State Aviation System Plan
SCEC	State Climate Extremes Committee
SCIP	Statewide Communication Interoperability Plan
SDS	Safety Data Sheets
SERS	Snohomish County Emergency Radio
SF_6	Sulfur Hexafluoride
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_3	Sulfur Trioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SOW	System On Wheels
SO_X	Oxides of Sulfur
SPL	Sound Pressure Level
SRCAA	Spokane Regional Clean Air Agency
SRS	Statewide Radio System
STARCOMM	Sioux Land Tristate Area Radio Communications
SUA	Special Use Airspace
SWAP	Source Water Assessment Program
SWCAA	Southwest Clean Air Agency
SWPPP	Storm Water Pollution Prevention Plan
TFR	Temporary Flight Restrictions
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load

Acronym	Definition
TNC	Transient Non-Community Systems
TPY	Pollutant Threshold Level
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
UA	Unmanned Aircraft
USACE	United States Army Corps of Engineers
UAS	Unmanned Aircraft Systems
UHF	Ultra High Frequency
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDOJ	United States Department of Justice
USDOT	United States Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compounds
WAAAQS	Washington State Ambient Air Quality Standards
WDL	Washington State Department of Labor
WDOE	Washington State Department of Energy
WDOH	Washington State Department of Health
WDOSH	Washington Division of Occupational Safety and Health
WMA	Wildlife Management Areas
WMD	Wetland Management District
WNHP	Washington National Heritage Program
WONDER	Wide-Ranging Online Data For Epidemiologic Research
WQC	Water Quality Certification
WSBH	Washington State Board of Health
WSDA	Washington State Department of Agriculture
WSDOT	Washington State Department of Transportation
WWI	World War I
WWII	World War II
YRCAA	Yakima Regional Clean Air Agency

WA APPENDIX A – WATER RESOURCES

Table A-1: Washington Federal Wild, Scenic, and Recreational Rivers

River Name	River Description	Designation
Illabot Creek	December 19, 2014. From the headwaters of Illabot Creek to approximately two miles upstream from its confluence with the Skagit River and just south of the Rockport-Cascade Road. The actual terminus is depicted on the map titled 'Illabot Creek Proposed WSR–Northern Terminus', dated September 15, 2009.	Wild — 4.3 miles; Scenic — 10.0 miles
Klickitat River	November 17, 1986. From the confluence with Wheeler Creek, near the town of Pitt, to the confluence with the Columbia River.	Recreational — 10.8 miles
Pratt River	December 19, 2014. The entire 9.5-mile Pratt River, from its headwaters to its confluence with the Middle Fork of the Snoqualmie River.	Wild — 9.5 miles
Skagit River	November 10, 1978. The segment from the pipeline crossing at Sedro-Wooley upstream to and including the mouth of Bacon Creek. The Cascade River from its mouth to the junction of its North and South Forks; the South Fork to the boundary of the Glacier Peak Wilderness Area. The Suiattle River from its mouth to the boundary of the Glacier Peak Wilderness Area at Milk Creek. The Sauk River from its mouth to its junction with Elliott Creek. The North Fork of the Sauk River from its junction with the South Fork of the Sauk to the boundary of the Glacier Peak Wilderness Area. The North Fork of the Cascade River from its confluence with the South Fork to the boundary of North Cascades National Park.	Scenic — 100.0 miles; Recreational — 58.5 miles
Snoqualmie (Middle Fork) River	December 19, 2014. The 27.4-mile segment from the headwaters of the Middle Fork Snoqualmie River near La Bohn Gap in NE 1/4, Section 20, Township 24 North, Range 13 East, to the northern boundary of Section 11, Township 23 North, Range 9 East.	Wild — 6.4 miles; Scenic — 21.0 miles
White Salmon River	November 17, 1986. From its confluence with Gilmer Creek, near the town of B Z Corner, to its confluence with Buck Creek. August 2, 2005. White Salmon River from its headwaters to the boundary of the Gifford Pinchot National Forest. Cascade Creek from its headwaters to its confluence with the White Salmon River. This designation is not contiguous with the 1986 designation farther downstream.	Wild — 6.7; Scenic — 21.0 miles

Source: (National Wild and Scenic Rivers System, 2015a)

WA APPENDIX B – BIOLOGICAL RESOURCES

Table B-1: S1-Ranked Terrestrial Sub Communities in Washington

Vegetative Community Type	USEPA Ecoregion(s)	Key Subcommunity Type	Distribution
Estuarine Intertidal	PT	Gravelly Low Marsh	
	PC	Sandy, Low-salinity, low marsh	
	PC, PT	Transition Zone Wetland	Elk River NRCA, Niawakum River NAP, North Bay NAP
Dune and Strand	PC	Coastal Spit with Native Vegetation	Cattle Point NRCA, Foulweather bluff, Leadbetter Point RNA, Niawakum River NAP
Westside Lowlands Conifer-Hardwood Forest	PT	Bigleaf Maple-Red Alder/Swordfern-Fringecup	
	PT	Douglas-fir-(Grand Fir, Western Red-cedar)/Dwarf Oregon-grape-Salal	Iceberg Point ACEC
	PT	Douglas-fir, Western redcedar/Salal, Oceanspray	
	PC	Lodgepole Pine, Sitka Spruce/Evergreen Huckelberry	
	PT	Paper birch, red alder/swordfern	
	NC	Sitka spruce/swordfern	South Nemah NRCA
	PT	Western red cedar, grand fir/swordfern	Patos Island PNAP
	PC	Western redcedar, Western hemlock/Salal/Deerfern	South Nolan NRCA
Westside oak and dry Douglas-fir forest and woodland	PT	Douglas-fir, Grand fir/snowberry/Alaska Oniongrass	
	PT	Douglas-fir/common snowberry, oceanspray	Sentinel Island
	PT	Oregon white oak/common snowberry/long-stolon sedge	Oak Patch NAP
	PT	Oregon white oak/long-stolon sedge, common camas	Bald Hill NAP
	PT,WC	Oregon white oak/poison-oak/blue wildrye	
	PT	Shore pine, Douglas-fir/Salal	Point Colville ACEC
Westside Grassland	PC	North Pacific herbaceous bald and bluff	Bald Hill NAP, Columbia Falls NAP
	PT	Ponderosa pine/Long-stolon sedge, roemer’s fescue	Bower woods RNA

Vegetative Community Type	USEPA Ecoregion(s)	Key Subcommunity Type	Distribution
	PT	Red fescue, great camas, Oregon gumweed	Ebey's landing, Waldron Island, Yellow Island
	PC	Roemer's fescue, field chickweed, prairie Junegrass	Bald Hill NAP, cypress highlands, NAP, cypress Island NRCA, Hat Island NRCA, Hope Island NAP, Mount Pickett NAP
	PT	Willamette Valley Wet Prairie	
Montane Conifer Forest	PC	Noble fir forest	Buttler Creek RNA, Goat Marsh RNA, Sister Rocks RNA, Table Mountain, Greanleaf Peak NRCA
	OK	Subalpine fir/Glandular Labrador-tea	Chopaka Mountain NAP
Subalpine Parkland	NC	Subalpine larch woodland	Boston Glacier RNA
	PC, CR	White-bark pine	Loomis NRCA
Eastside Mixed Conifer Forest	EC	Douglas-fir/Oceanspray	Table Mountain. Greenleaf Peak NRCA
	CR	Grand fir/big huckleberry	Pataha Bunchgrass RNA, Rainbow Creek RNA
	CP	Grand fir/pinegrass	Meeks Table RNA
	OK	Grand fir/Queen's cup	Maltlen Creek RNA, Ragged Ridge NAP
	EC	Western larch forest	Baird Basin RNA, Maltlen Creek RNA, Rainbow Creek RNA, Varline Grove RNA, Maple Mountain PRNA, Fire Mountain PRNA
	OK	Western redcedar, Queen's cup	Maltlen Creek RNA
Ponderosa Pine and Eastside Oak Forest and Woodland	EC, CP	Oregon white oak/blue wildrye	Klickitqat Oaks Preserve
	CP	Oregon white oak/bluebunch wheatgrass	Monte Cristo NAP/RNA
	EC	Ponderosa pine/bitterbrush	Davis Canyon NAP, Entiat Slopes NAP, Spring Creek Canyon NAP
	OK, CH, CP	Ponderosa pine/bluebunch wheatgrass	Pinecroft NAP, Maple Mountain PRNA
	OK	Ponderosa pine/Idaho fescue	Baird Basin RNA, Pine Creek RNA< Turnbull Pine RNA, Maple Mountain PRNA
	CP	Ponderosa Pine/Mallow-leaf ninebark	Pinecroft NAP, Smoot Hill BSA

Vegetative Community Type	USEPA Ecoregion(s)	Key Subcommunity Type	Distribution
	OK, CP	Ponderosa Pine/needle and thread	Upper Deep Creek NAP
	OK	Ponderosa Pine/Pinegrass	Pathaha Bunchgrass RNA, Pine Creek RNA
Western Juniper and Mountain Mahogany Woodland	BM	Curl-leaf Mountain Mahogany/Idaho Fescue	
Eastside Canyon Shrubland	CP	Netleaf hackberry/bluebunch wheatgrass	
	OK, CP	Smooth sumac/bluebunch wheatgrass	Methow Rapids NAP, Riverside Breaks NAP
Eastside Grassland	CP	Bluebunch wheatgrass, Sanberg's bluegrass	Badger Gulch NAP, Columbia Hills NAP, Kramer Palouse BSA, Rainbow Creak RNA, Rock Creek
	CP	Idahe Fescue/Nootka Rose	
	CP	Needle-and-thread, Sanberg's bluegrass	
	CP	Red Threeawn, Sanberg's bluegrass	
	OK, CR, CP	Rough Fescue, Idahoe Fescue	
Shrub-steppe	EC	Bitterbrush/Idaho fescue	Barker Mountain NAP, Cleaveland shrub steppe NAP, Davis Canyon NAP, Wolf Creek RNA
	OK, CP	Bitterbrush/Needle-and-thread	
	CP	Inter-Mountain Basins Active and Stabilized Dune	Juniper Forest ACEC
	OK, CP	Threetlp Sagebrush/Needle-and-thread	Castle Rock NAP, Rattlesnake Hills RNA
	OK, CP	Wyoming big sagebrush/needle-and-thread	Castle Rock NAP, Davis Canyon NAP, Hawatha Sageflats PRNA
Dwarf Shrub-steppe	CP	Bushy buckwheat/Oregon double bladderpod	
Desert Playa and Salt Scrub Shrubland	CP	Giant wildrye, alkali saltgrass	
	OK,CP	Low elevation alkali wetland	
	OK,CP	Low elevation saline wetland	
	CP	Saltgrass	Lower Crab Creek NAP
	CP	Spiny hopsage/sanberg's bluegrass	Rattlesnake Hills RNA
Riparian	CP	Quaking aspen/black hawthorn, common snowberry	Kramer Palouse BSA, Rose Creek

Vegetative Community Type	USEPA Ecoregion(s)	Key Subcommunity Type	Distribution
	CP	Quaking aspen/black howthorn, cowparsnip	Kramer Palouse BSA, Rose Creek
	PT	Black cottonwood, bigleaf maple	Nisqually Floodplain RNA
	PT	Black cottonwood, Oregon ash	Pierce Island, White Island NAP
	PT	Black cottonwood, red alder	
	CP	Black cottonwood /Western hemlock	
	CP	Hot spring	
	PT	Oregon white oak, Oregon ash/common snowberry	Thirteen Division Prairie RNA
	PT,WC	Overflow Plain	Blackwater Islands RNA
	CP	Peachleaf willow	Rattlesnack Hills RNA
	EC, CR, CP	Quaking aspen riparian forest	
	BM	Red alder/mallow-leaf ninebark	Mill Creek Watershed PRNA
	CP	Syringa riparian shrubland	McCartney Creek
	CP	Water birch riparian shrubland	McCartney Creek
	BM	White Alder	Badger Gulch NAP, Rock Creek
Freshwater wetlands	OK	Calciferous wetland	Halliday Fen RNA
	PT	Forested sphagnum bog	Clearwater Bogs NAP, Copalis River, Shumocher Creek NAP, South Nolan Old Growth NRCS
	PT	Freshwater Tidal Surge Plain Wetland	Chehalis River Surger Plain NAP, Grays Bay Wetlands, White Island NAP
	EC, OK	Mid-elevation freshwater wetland	Dailey Prairie NAP, Goat Marsh RNA, Little Pend Oreille river NAP, Mount Pilchuck NRCA, Mount SI NRCA, Steamboat Mountain RNA, Trout Lake NAP, Thirteen Mile Ponds PRNA, Hall Ponds PRNA
	CP	Tufted Hairgrass Meadow	Elk Flats Meadow PRNA
	PT, CP	Vernal Pond	Castle Rock NAP, Marcellus shrub steppe NAP
	PT	Western Red Cedar, Western Hemlock/skunk cabbage	Cedar Flats RNA, Snoqualmie Bog NAP, Stetattle Creek RNA, Table

Vegetative Community Type	USEPA Ecoregion(s)	Key Subcommunity Type	Distribution
			Mountain/Greenleaf Peak NRCA
Open Water-Lakes, Rivers, Streams	OK, CP	Low Elevation Alkali Pond/Lake	
	PT, EC, OK, CR, CP	Low Elevation Permanent Pond	Big Beaver RNA, Carlisle Bog NAP, Cypress Highlands NAP, Kings Lake Bog NAP, Snoqualmie Bog NAP
	PT, EC, OK, CR, CP	Low Elevation Stream	Badger Gulch NAP, Big Beaver RNA, Castle Rock NAP, Columbia Falls NAP, :Ong Creek RNA, Quinault RNA, Rattlesnake Hills RNA, Steattle Creek RNA
	EC	Mid-Elevation Lake	Lake Twenty-two RNA, Lily Lake PRNA

Source: (WNHP, 2011a)

Table B-2: Essential Fish Habitat Offshore of Washington

Common Name	Eggs	Larvae/YOY[166]	Juveniles	Adults
Albacore Tuna	None	None	Oceanic, epipelagic waters beyond the 100 fathom (fm) isobath.	Oceanic, epipelagic waters beyond the 100fm isobath.
Northern Bluefin Tuna	None	None	Oceanic, epipelagic waters beyond the 100 fm isobath.	None
Chinook Salmon	None	None	Marine populations for this life state are found in estuarine areas and from the mean higher tide line to the 200 nautical mile (nm)-limit	Marine populations for this life state are found in estuarine areas and from the mean higher tide line to the 200 nm-limit
Chum Salmon	Spawn in the lower reaches of coastal streams less than 100 miles from the ocean.	Fry migrate to sea shortly after emergence	Stay in coastal waters	Migrate to streams for spawning.

[166] YOY (Young of the year): "All of the fish of a species that were born in the past year, from transformation to juvenile until January 1" (USEPA, 2016a).

Common Name	Eggs	Larvae/YOY[166]	Juveniles	Adults
Coho Salmon	Spawns in August-November in rivers and hatcheries	None	Marine populations for this life state are found in estuarine areas and from the mean higher tide line to the 200 nm limit.	Marine populations for this life state are found in estuarine areas and from the mean higher tide line to the 200 nm-limit
Pink Salmon	Gravel sites at depths 30-100 cm. Spawning beds on riffles with clean gravel in shallow water, in large rivers within discrete locations.	Gravel sites at depths 30-100cm. Spawning beds on riffles with clean gravel in shallow water, in large rivers within discrete locations. Enter estuaries early as pre-fry.	New fry prefer saline water over fresh water and tend to follow shorelines.	Mature adults return to estuaries inhabited as pre-fry.
Groundfish management unit	Multiple species that typically live on or near the bottom of the ocean are included in the west coast ground fish management unit Species groups include skates, sharks, rockfish, flatfish, and groundfish. The overall extent of groundfish EFH included wasters and substrates: With depths less than or equal to 3,500m to mean higher high water or the up-river extent of saltwater intrusion. Seamonts in depths greater than 3,5000 m as mapped Areas designated as HAPCs no already identified by the above criteria			
Pacific sardine	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius
Pacific (chub) mackerel	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius

Common Name	Eggs	Larvae/YOY[166]	Juveniles	Adults
Northern anchovy	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius
Jack mackerel	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius
Market squid	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius
Pacific sand lance	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius	All marine and estuary waters to the limits of the 200 nm limit and above the thermocline where sea surface temperatures range between 10° and 26° Celsius
Common Thresher Shark	None	NA	None	Found in warmers seasonally to Cape Flattery, WA
Blue Shark	From the 100 fm isobaths to the 1000fm isobaths	NA	From the 100 fm isobaths to the outer boundary of the EZZ	Beyond the 1000 fm isobath

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