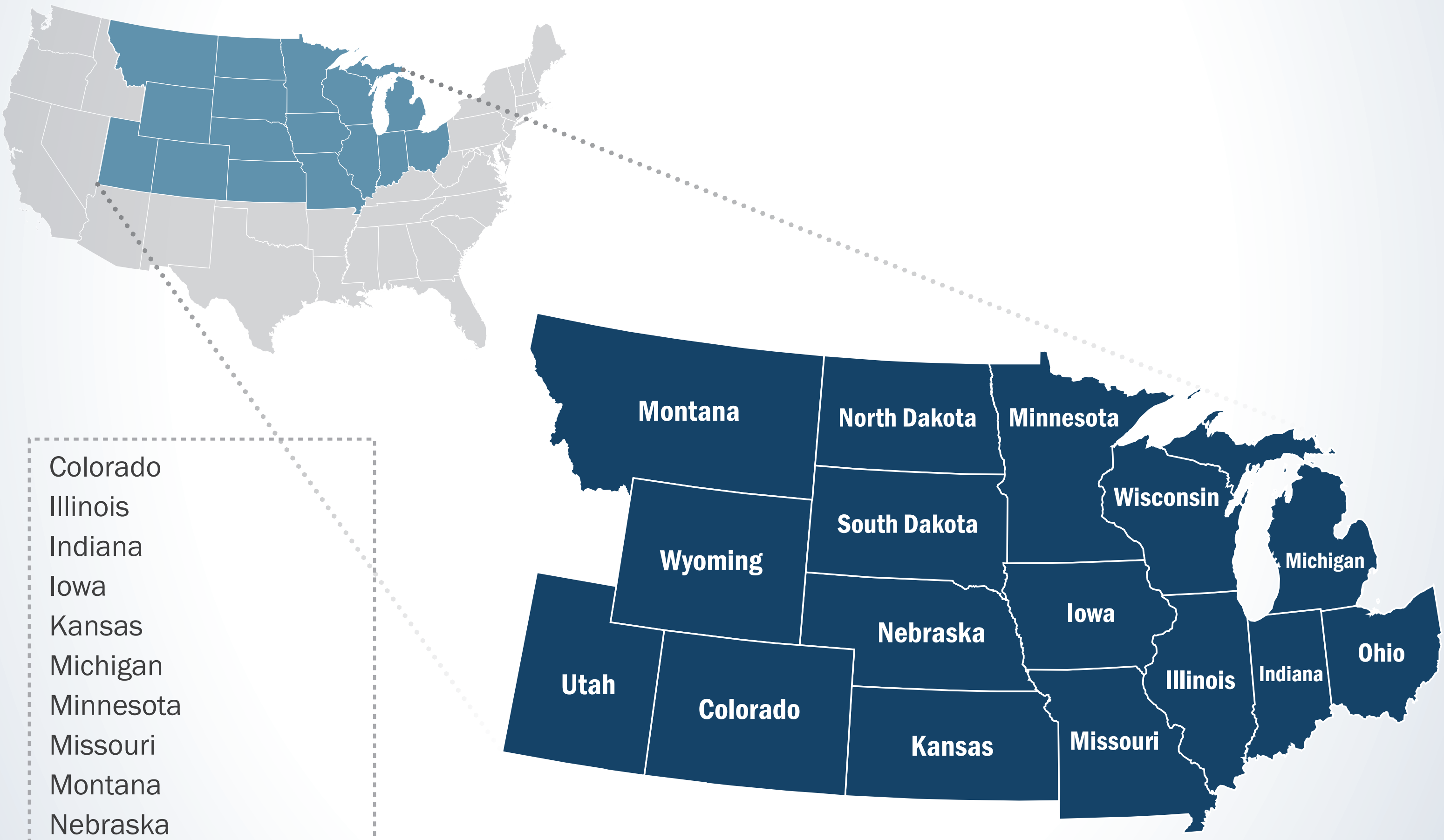
Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Central United States

VOLUME 16 - CHAPTER 18



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First Responder Network Authority

FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Central United States

VOLUME 16 - CHAPTER 18

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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

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Contents

18. Wyoming 18-6
18.1. Affected Environment 18-7
18.1.1. Infrastructure 18-7
18.1.2. Soils 18-30
18.1.3. Geology 18-42
18.1.4. Water Resources 18-61
18.1.5. Wetlands 18-71
18.1.6. Biological Resources 18-77
18.1.7. Land Use, Recreation, and Airspace 18-100
18.1.8. Visual Resources 18-125
18.1.9. Socioeconomics 18-139
18.1.10. Environmental Justice 18-157
18.1.11. Cultural Resources 18-162
18.1.12. Air Quality 18-173
18.1.13. Noise 18-184
18.1.14. Climate Change 18-188
18.1.15. Human Health and Safety 18-197
18.2. Environmental Consequences 18-210
18.2.1. Infrastructure 18-210
18.2.2. Soils 18-222
18.2.3. Geology 18-229
18.2.4. Water Resources 18-241
18.2.5. Wetlands 18-255
18.2.6. Biological Resources 18-266
18.2.7. Land Use, Recreation, and Airspace 18-313
18.2.8. Visual Resources 18-327
18.2.9. Socioeconomics 18-334
18.2.10. Environmental Justice 18-347
18.2.11. Cultural Resources 18-354
18.2.12. Air Quality 18-363
18.2.13. Noise 18-370
18.2.14. Climate Change 18-377
18.2.15. Human Health and Safety 18-391
WY Appendix A – Biological Resources 18-406
Acronyms 18-408
References 18-414
Geographic Information Systems (GIS) References 18-448

List of Tables

Table 18.1.1-1: Relevant Wyoming Infrastructure Laws and Regulations 18-8
Table 18.1.1-2: Wyoming Interstates.. 18-9
Table 18.1.1-3: Key Wyoming Indicators 18-12
Table 18.1.1-4: Public Safety Infrastructure in Wyoming by Type 18-12
Table 18.1.1-5: First Responder Personnel in Wyoming by Type 18-12
Table 18.1.1-6: Telecommunications Access Providers and Coverage (2013) 18-17
Table 18.1.1-7: Wireless Telecommunications Coverage by Providers in Wyoming.. 18-18
Table 18.1.1-8: Number of Commercial Towers in Wyoming by Type 18-23
Table 18.1.1-9: Fiber Provider Coverage 18-26
Table 18.1.2-1: Relevant Wyoming Soil Laws and Regulations................................ 18-31
Table 18.1.2-2: Characteristics of Major Land Resource Areas in Wyoming............ 18-34
Table 18.1.2-3: Major Characteristics of Soil Suborders Found in Wyoming, as depicted in Figure 18.1.2-2 18-37
Table 18.1.3-1: Relevant Wyoming Geology Laws and Regulations 18-43
Table 18.1.4-1: Relevant Wyoming Water Laws and Regulations 18-61
Table 18.1.4-2: Section 303(d) Impaired Waters of Wyoming, 2012 18-65
Table 18.1.4-3: Description of Wyoming’s Principal Aquifers.................................. 18-69
Table 18.1.5-1: Relevant Wyoming Laws and Regulations 18-71
Table 18.1.5-2: Wyoming Wetland Types, Descriptions, Location, and Amount, 2014.. 18-73
Table 18.1.6-1: Relevant Wyoming Biological Resources Laws and Regulations 18-77
Table 18.1.6-2: USEPA Level III Ecoregions of Wyoming....................................... 18-80
Table 18.1.6-3: Federally Listed Mammal Species of Wyoming............................... 18-93
Table 18.1.6-4: Federally Listed Bird Species of Wyoming 18-96
Table 18.1.6-5: Federally Listed Fish Species of Wyoming 18-97
Table 18.1.6-6: Federally Listed Amphibian Species of Wyoming 18-98
Table 18.1.6-7: Federally Listed Plant Species of Wyoming 18-99
Table 18.1.7-1: Major Land Uses in Wyoming by Coverage Type.......................... 18-102
Table 18.1.7-2: Top Five Developed Metropolitan Areas.. 18-104
Table 18.1.7-3: Federal Land in Wyoming... 18-107
Table 18.1.7-4: Indian Reservations in Wyoming.. 18-108
Table 18.1.7-5: SUA Designations 18-115
Table 18.1.7-6: Other Airspace Designations.. 18-116
Table 18.1.7-7: Type and Number of Wyoming Airports/Facilities 18-118
Table 18.1.8-1: Relevant Wyoming Visual Resources State Laws and Regulations 18-125
Table 18.1.8-2: U.S. Forest Service Lands in Wyoming... 18-134
Table 18.1.8-3: National Recreation Trails.. 18-135
Table 18.1.8-4: Wyoming State Parks and Associated Visual Attributes 18-136
Table 18.1.8-5: National Natural Landmarks with Scenic Resources....................... 18-137
Table 18.1.8-6: Congressionally Designated Wilderness in Wyoming..................... 18-138
Table 18.1.8-7: Wyoming State Scenic and Historic Routes.................................... 18-139
Table 18.1.9-1: Land Area, Estimated Population, and Population Density of Wyoming.. 18-142
Table 18.1.9-2: Recent Population Growth of Wyoming... 18-142

Table 18.1.9-3: Projected Estimated Population Growth of Wyoming 18-143
Table 18.1.9-4: Population of the 10 Largest Population Concentrations in Wyoming.. 18-145
Table 18.1.9-5: Selected Economic Indicators for Wyoming................................... 18-147
Table 18.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Wyoming, 2009–2013 18-151
Table 18.1.9-7: Employment by Class of Worker and by Industry, 2013 18-151
Table 18.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in Wyoming, 2009–2013 18-152
Table 18.1.9-9: Selected Housing Indicators for Wyoming, 2013 18-153
Table 18.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Wyoming, 2009–2013 18-153
Table 18.1.9-11: Residential Property Values in Wyoming, 2013 18-154
Table 18.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Wyoming, 2009–2013 18-155
Table 18.1.9-13: State and Local Government Revenues, Selected Sources, 2012 .. 18-156
Table 18.1.10-1: Estimated Population by Race and Hispanic Status, 2013............. 18-158
Table 18.1.10-2: Percentage of Estimated Population (Individuals) in Poverty, 2013... 18-159
Table 18.1.11-1: Relevant Wyoming Cultural Resources Laws and Regulations..... 18-162
Table 18.1.11-2: Archaeological Sites on the National Register of Historic Places in Wyoming 18-167
Figure 18.1.11-3: Representative Architectural Styles of Wyoming......................... 18-173
Table 18.1.12-1: Wyoming Ambient Air Quality Standards.................................... 18-175
Table 18.1.12-2: Major Air Pollutant Source Thresholds.. 18-176
Table 18.1.12-3: *De Minimis* Levels.. 18-178
Table 18.1.12-4: Wyoming Nonattainment and Maintenance Areas by Pollutant Standard and County.. 18-181
Table 18.1.12-5: Relevant Federal Class I Areas 18-182
Table 18.1.13-1: Relevant Wyoming Noise Laws and Regulations.......................... 18-186
Table 18.1.14-1: Wyoming CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013 18-190
Table 18.1.15-1: Relevant Wyoming Human Health and Safety Laws and Regulations 18-198
Table 18.2.1-1: Impact Significance Rating Criteria for Infrastructure.................... 18-212
Table 18.2.2-1: Impact Significance Rating Criteria for Soils 18-223
Table 18.2.3-1: Impact Significance Rating Criteria for Geology............................ 18-231
Table 18.2.4-1: Impact Significance Rating Criteria for Water Resources 18-243
Table 18.2.5-1: Impact Significance Rating Criteria for Wetlands 18-256
Table 18.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats... 18-267
Table 18.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species 18-301
Table 18.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace 18-314
Table 18.2.8-1: Impact Significance Rating Criteria for Visual Resources 18-328

Table 18.2.9-1: Impact Significance Rating Criteria for Socioeconomics 18-335
Table 18.2.10-1: Impact Significance Rating Criteria for Environmental Justice..... 18-348
Table 18.2.11-1: Impact Significance Rating Criteria for Cultural Resources.......... 18-356
Table 18.2.12-1: Impact Significance Rating Criteria for Air Quality 18-365
Table 18.2.13-1: Impact Significance Rating Criteria for Noise 18-372
Table 18.2.14-1: Impact Significance Rating Criteria for Climate............................ 18-379
Table 18.2.15-1: Impact Significance Rating Criteria for Human Health and Safety 18-393

List of Figures

Figure 18.1.1-1: Wyoming Transportation Networks... 18-10
Figure 18.1.1-2: Wireless Network Configuration 18-13
Figure 18.1.1-3: Wyoming Repeater Tower Locations 18-15
Figure 18.1.1-4: WyoLink Mobile Coverage 18-16
Figure 18.1.1-5: AT&T and Verizon Wireless Availability in Wyoming.................. 18-19
Figure 18.1.1-6: Union Wireless, Wireless Availability in Wyoming 18-20
Figure 18.1.1-7: Other Providers Wireless Availability in Wyoming......................... 18-21
Figure 18.1.1-8: Types of Towers... 18-22
Figure 18.1.1-9: FCC Tower Structure Locations in Wyoming 18-24
Figure 18.1.1-10: Typical Fiber Optic Network in Wyoming..................................... 18-25
Figure 18.1.1-11: Fiber Availability in Wyoming for CenturyLink and RT Communications, Inc. 18-27
Figure 18.1.1-12: Other Providers Fiber Availability in Wyoming............................ 18-28
Figure 18.1.2-1: Locations of Major Land Resource Areas in Wyoming 18-33
Figure 18.1.2-2: Wyoming Soil Taxonomy Suborders.. 18-36
Figure 18.1.3-1: Physiographic Regions, Provinces, and Sections of Wyoming 18-45
Figure 18.1.3-2: Generalized Surface Geology for Wyoming..................................... 18-48
Figure 18.1.3-3: Generalized Bedrock Geology for Wyoming 18-50
Figure 18.1.3-4: Location of the Yellowstone Caldera.. 18-54
Figure 18.1.3-5: Wyoming 2014 Seismic Hazard Map 18-56
Figure 18.1.3-6: Wyoming Landslide Incidence and Susceptibility Hazard Map....... 18-58
Figure 18.1.3-7: Karst Topography in Wyoming 18-60
Figure 18.1.4-1: Major Wyoming Watersheds and Surface Waterbodies.................. 18-63
Figure 18.1.4-2: Wild and Scenic Snake River Headwaters, Granite Creek 18-64
Figure 18.1.4-3: Section 303(d) Impaired Waters of Wyoming, 2014........................ 18-66
Figure 18.1.4-4: Principal and Sole Source Aquifers of Wyoming............................. 18-70
Figure 18.1.5-1: Wetlands by Type, Wyoming, 2014 18-75
Figure 18.1.6-1. USEPA Level III Ecoregions in Wyoming...................................... 18-79
Figure 18.1.6-2: Important Bird Areas in Wyoming 18-86
Figure 18.1.6-3: Critical Habitat in Wyoming.. 18-92
Figure 18.1.7-1: Major Land Use Distribution by Coverage Type............................ 18-105
Figure 18.1.7-2: Land Ownership Distribution.. 18-106
Figure 18.1.7-3: Wyoming Recreation Resources 18-110
Figure 18.1.7-4: National Air Space Classification Profile 18-114
Figure 18.1.7-5: Wyoming Public and Private Airports/Facilities 18-119

Figure 18.1.7-6: Public Wyoming Airports/Facilities 18-120
Figure 18.1.7-7: Private Wyoming Airports/Facilities 18-121
Figure 18.1.7-8: SUAs in Wyoming 18-123
Figure 18.1.7-9: MTRs in Wyoming 18-124
Figure 18.1.8-1: Representative Sample of Cultural and Heritage Resources that May be Visually Sensitive 18-128
Figure 18.1.8-2: Natural Areas that May be Visually Sensitive 18-131
Figure 18.1.8-3: Grand Teton National Park 18-132
Figure 18.1.8-4: Devils Tower National Monument 18-133
Figure 18.1.9-1: Estimated Population Distribution in Wyoming, 2009–2013 18-144
Figure 18.1.9-2: Median Household Income in Wyoming, by County, 2013 18-149
Figure 18.1.9-3: Unemployment Rates in Wyoming, by County, 2014 18-150
Figure 18.1.10-1: Potential for Environmental Justice Populations in Wyoming, 2009–2013 18-161
Figure 18.1.11-1: Timeline of Prehistoric Human Occupation 18-164
Figure 18.1.11-2: Approximate Historic Boundaries of Tribes in Wyoming 18-166
Figure 18.1.11-3: National Heritage Area and National Register of Historic Sites in Wyoming 18-171
Figure 18.1.12-1: Nonattainment and Maintenance Counties in Wyoming 18-180
Figure 18.1.12-2: Federal Class I Areas with Implications for Wyoming 18-183
Figure 18.1.13-1: Sound Levels of Typical Sounds 18-185
Figure 18.1.14-1: Wyoming CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013 18-190
Figure 18.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties 18-192
Figure 18.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014 18-201
Figure 18.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Wyoming (2013) 18-204
Figure 18.1.15-3: High Priority Abandoned Mine Lands in Wyoming (2013) 18-207
Figure 18.2.14-1: Wyoming Low Emission Scenario Projected Temperature Change 18-381
Figure 18.2.14-2: Wyoming High Emission Scenario Projected Temperature Change 18-381
Figure 18.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario 18-384
Figure 18.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario 18-385

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18. WYOMING

American Indian tribes with a rich cultural history lived in what is now the state of Wyoming for centuries before the 1800s. Beaver trappers, gold seekers, and pioneers were among the first Europeans to visit and settle in Wyoming. Organized as a territory in 1868, Wyoming became the 44th state to enter the Union in 1890. Women in Wyoming were the first in the nation to be granted suffrage, and Wyoming was also the first state in the nation to elect a female governor (State of Wyoming, 2013a). Wyoming is bordered by Montana to the north, Idaho and Utah to the west, South Dakota and Nebraska to the east, and Colorado to the south. This chapter provides details about the existing environment of Wyoming as it relates to the Proposed Action.

General facts about Wyoming are provided below:

- **State Nickname**: The Equality State (State of Wyoming, 2013b)
- **Land Area:** 97,093.14 square miles; **United States (U.S.) Rank**: 9 (U.S. Census Bureau, 2015a)
- **Capital:** Cheyenne (State of Wyoming, 2013b)
- **Counties:** 23 (State of Wyoming, 2013a)
- **2015 Estimated Population:** 586,107; **U.S. Rank:** 51[1] (U.S. Census Bureau, 2015a) (U.S. Census Bureau, 2015d)
- **Most Populated Cites:** Cheyenne and Casper (U.S. Census Bureau, 2015b)
- **Main Rivers:** Sweetwater River, North Platte River, Yellowstone River, and Bighorn River (WWDC, 2007)
- **Bordering Waterbodies:** None
- **Mountain Ranges:** Big Horn Mountains, Laramie Mountains, Wind River Range, Wyoming Range, Absaroka Range, Teton Range, and a portion of the Rocky Mountains (Wyoming State Geological Survey, 2016)
- **Highest Point:** Gannett Peak (13,804 ft.) (USGS, 2015a)

[1] This ranking accounts for the District of Columbia.

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18.1. AFFECTED ENVIRONMENT

18.1.1. Infrastructure

18.1.1.1. Definition of the Resource

This section provides information on key Wyoming 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 man-made 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, and other man-made 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 18.1.1.3 provides an overview of the traffic and transportation infrastructure in Wyoming, including road and rail networks and airport facilities. Wyoming public safety infrastructure could include any infrastructure utilized by a public safety entity[2] as defined in the Act, including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by 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). Public safety services in Wyoming are presented in more detail in Section 18.1.1.4. Section 18.1.1.5 describes specific public safety communications infrastructure and commercial telecommunications infrastructure in Wyoming. An overview of utilities in Wyoming, such as power, water, and sewer, are presented in Section 18.1.1.6.

18.1.1.2. Specific Regulatory Considerations

Multiple Wyoming laws and regulations pertain to the state’s public utility and transportation infrastructure and its public safety community. Table 18.1.1-1 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.

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

Table 18.1.1-1: Relevant Wyoming Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Wyoming Statutes Annotated: Title 35 Public Health and Safety	Wyoming Office of Homeland Security (WOHS)	Provides for the rendering of mutual aid among political subdivisions of the state and other states with respect to emergency preparedness and homeland security.
Wyoming Statutes Annotated: Title 37 Public Utilities	Public Service Commission (PSC)	Defines "public utility" as every person that owns, operates, leases, or controls any plan, property, or facility engaged in furnishing to the public electricity, natural or manufactured gas, or water and any plant, property, or equipment engaged in the transportation of oil by pipeline; supervises all public utilities in the state; regulates telecommunications companies and services.
Wyoming Statutes Annotated: Title 24 Highways	Wyoming Department of Transportation (WYDOT)	Grants rights-of-way to counties for roads and highways over and across lands ceded to the state; establishes rules and regulations regarding railroads; regulates traffic on highways; establishes rules and regulations relating to motor vehicles.

Source: (Wyoming Legislature, 2015) (Wyoming Secretary of State, 2014)

18.1.1.3. Transportation

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

The Wyoming Department of Transportation (WYDOT) has jurisdiction over freeways and major roads, airports, and railroads in the state; local counties have jurisdiction for smaller streets and roads. The mission of the WYDOT is to "provide a safe, high quality, and efficient transportation system" (WYDOT, 2013).

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

- 29,024 miles of public roads (FHWA, 2014) and 3,127 bridges (FHWA, 2015a);
- 1,868 miles of rail network (WYDOT, 2015a);
- 122 aviation facilities, including airstrips and heliports (FAA, 2015a); and
- No major harbors or ports (U.S. Harbors, 2015).

Road Networks

As identified in Figure 18.1.1-1, the major urban centers of the state are Casper in the center and Cheyenne in the southeast. Wyoming has three major interstates connecting its major metropolitan areas to one another, as well as to other states. Travel outside the major metropolitan areas is conducted on interstates, state, and county routes. Table 18.1.1-2 lists the interstates and their start/end points in Wyoming. Per the national standard, even numbered interstates run from west to east with the lowest numbers beginning in the west; odd numbered interstates run from north to south with the lowest numbers beginning in the south (FHWA, 2015b).

Table 18.1.1-2: Wyoming Interstates

Interstate	Southern or Western Terminus in WY	Northern or Eastern Terminus in WY
I-25	CO line near Cheyenne	I-90 at Buffalo
I-80	UT line near Evanston	NE line at Pine Bluffs
I-90	MT line near Parkman	SD line near Beulah

In addition to the Interstate System, Wyoming 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 18.1.1-1 illustrates the major transportation networks, including roadways, in Wyoming. Section 18.1.8, Visual Resources, describes the National and State Scenic Byways found in Wyoming from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the byways are designated and managed by the U.S. Department of Transportation's (USDOT) Federal Highway Administration (FHWA). Wyoming has one National Scenic Byway, the Beartooth Highway, running 68.7 miles through Montana and Wyoming. (FHWA, 2015c)

State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by WYDOT. Some State Scenic Byways may be designated on portions of National Scenic Byways. Wyoming has 16 State Scenic Byways that crisscross the entire state (Wyoming Tourism, 2015k):[3]

- Bighorn Scenic Byway
- Bridger Valley Historic Byway
- Buffalo Bill Cody Scenic Byway
- Centennial Scenic Byway
- Chief Joseph Scenic Byway
- Cloud Peak Skyway Scenic Byway
- Flaming Gorge – Green River Basin Scenic Byway
- Mirror Lake Scenic Byway
- Snowy Range Scenic Byway
- Wind River Canyon Scenic Byway
- Big Spring Scenic Backway
- Muddy Creek Historic Backway
- South Big Horn/Red Wall Scenic Backway
- Red Gulch/Alkali Scenic Backway
- Cloud Park Skyway Scenic Byway
- Star Valley Scenic Byway

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

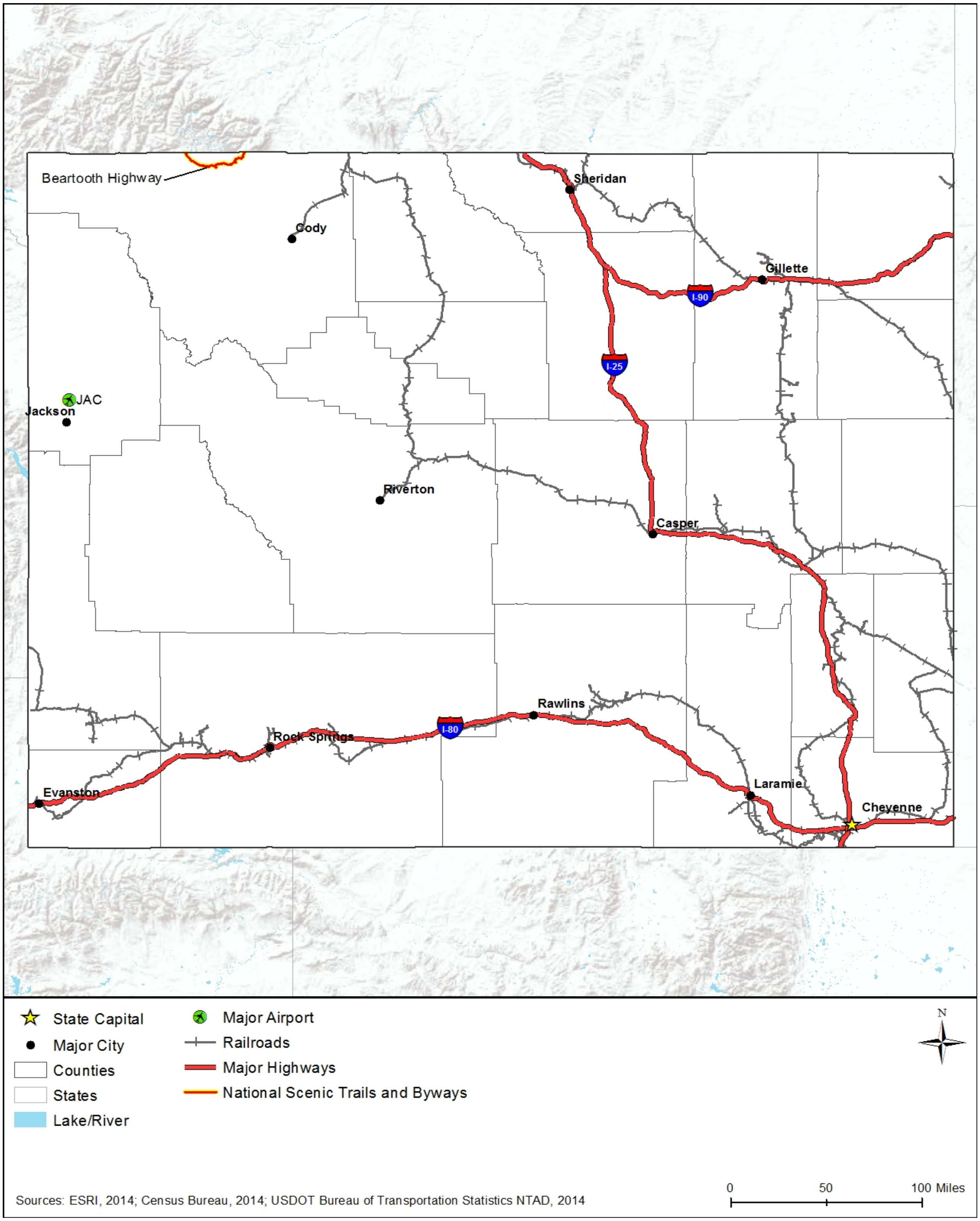

Figure 18.1.1-1: Wyoming Transportation Networks

Airports

Air service to the state is provided by Jackson Hole Airport (JAC) outside the Town of Jackson, which is the largest airport in the state. In 2014, JAC served 308,509 enplanements, making it the 155th busiest airport in the nation (FAA, 2015b). The airport is located within Grand Teton National Park, making it the nation's only airport entirely within a national park (Jackson Hole, 2015). Figure 18.1.1-1 illustrates Wyoming's major transportation networks, including the state's only major airport in Jackson Hole. Other important airports within the state include: Camp Guernsey (Guernsey), Natrona County International (Casper), Cheyenne (Cheyenne), and Gilette-Campbell County (Gillette). Section 18.1.7.5, Airspace, provides greater detail on airports and airspace in Wyoming.

Rail Networks

Wyoming is connected to a network of freight rail. The Federal Railroad Administration (FRA) classifies railroads as Class I, Class II, or Class III based on corporate revenue thresholds (FRA, 2015a). All 1,868 miles of track in Wyoming are owned and operated by freight rail companies: Burlington Northern and Santa Fe (BNSF) Railway and Union Pacific Railroad, both Class I railroads, own 1,844 miles of track in the state[4] (WYDOT, 2015a). Over 559 million tons of freight traveled through Wyoming via freight rail in 2011 (WYDOT, 2015a). That same year, about 460.5 million tons of freight originated, 2.2 million tons terminated, and 82.2 million tons passed through Wyoming (WYDOT, 2015a). Approximately 96 percent of the commodities traveling by freight rail in Wyoming is coal (WYDOT, 2015a). Amtrak does not run any lines through Wyoming; Amtrak discontinued its passenger train service in the state in 1997 (WYDOT, 2015a). Figure 18.1.1-1 illustrates the major transportation networks, including rail lines, in Wyoming.

Harbors

Wyoming is a landlocked state and has no major harbors.

18.1.1.4. Public Safety Services

Wyoming public safety services generally consist of public safety infrastructure and first responder personnel throughout the state. The general abundance and distribution of public safety services may roughly follow key state demographic indicators.

Table 18.1.1-3 presents Wyoming's key demographics including estimated population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 18.1.9, Socioeconomics.

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[4] "Canadian Pacific Railway (CP) owns an additional 7 route-miles. The two short-line railroads operating in the state own the remaining 17 route-miles in Wyoming" (WYDOT, 2015a).

Table 18.1.1-3: Key Wyoming Indicators

Wyoming Indicators	
Estimated Population (2015	586,107
Land Area (square miles) (2010)	97,093.14
Population Density (persons per sq. mile) (2010)	5.8
Municipal Governments (2013)	99

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

Table 18.1.1-4 presents Wyoming's public safety infrastructure, including fire and police stations. Table 18.1.1-5 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 18.1.1-4: Public Safety Infrastructure in Wyoming by Type

Infrastructure Type	Number
Fire and Rescue Stations [a]	248
Law Enforcement Agencies [b]	90
Fire Departments [c]	115

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

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

Table 18.1.1-5: First Responder Personnel in Wyoming by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers [a]	260
Fire and Rescue Personnel [b]	3,290
Law Enforcement Personnel [c]	2,990
Emergency Medical Technicians and Paramedics [d e]	670

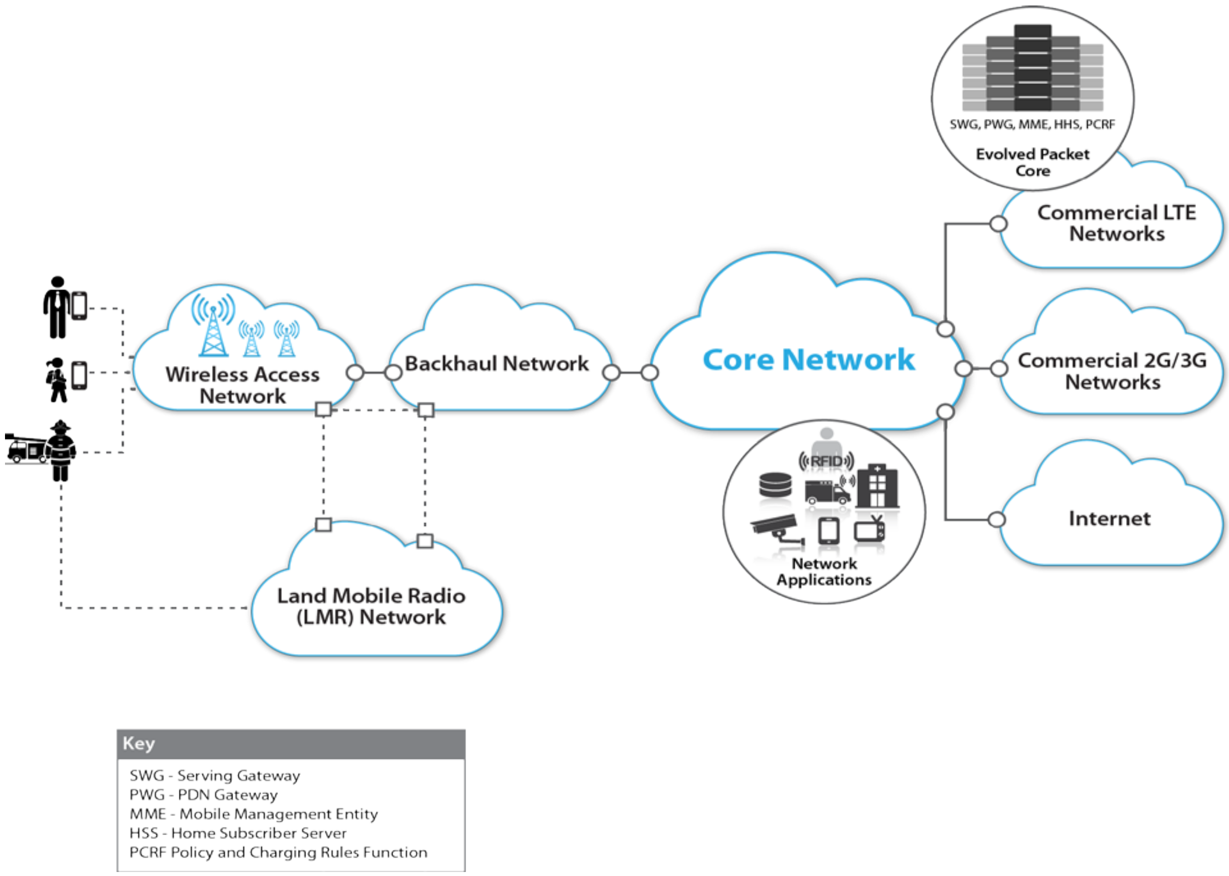
[a] BLS Occupation Code: 43-5031.
[b] BLS Occupation Codes: 33-2011 (Firefighters), 33-2021 (Fire Inspectors and Investigators), 33-1021 (First-Line Supervisors of Fire Fighting and Prevention Workers), and 53-3011 (Ambulance Drivers and Attendants, Except Emergency Medical Technicians). Volunteer firefighters 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)

18.1.1.5. Telecommunications Resources

There is no central repository of information for public safety communications infrastructure and commercial telecommunications infrastructure in Wyoming; 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.

Figure 18.1.1-2 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).



Prepared by: Booz Allen Hamilton

Figure 18.1.1-2: Wireless Network Configuration

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as LTE (see Section 18.1.1), has the potential to provide users with better coverage, while offering additional capacity and enabling the use of new applications that would likely make their work safer and more efficient. Designing such a network presents several challenges due to the uniqueness of the deployment, the requirements, and the nationwide scale (NIST, 2015). Historically, there have been many challenges and impediments to timely and effective sharing of information. Communication interoperability has also been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the U.S. and at the state level, including in Wyoming. 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 help enable the public safety community to incorporate disparate Land Mobile Radio (LMR) networks with a nationwide public safety LTE broadband network, the U.S. Department of Commerce (DOC) Public Safety Communications Research (PSCR), prepared a locations-based services (LBS) research and development roadmap to examine the current state of location-based technologies, forecast the evolution of LBS capabilities and gaps, and identify potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years to better inform investment decisions (PSCR, 2015).

Like most states, Wyoming's Public Safety LMR network environment is facing transition and reflects the challenges of the need for greater system capabilities, investment in Very High Frequency (VHF)[5] upgrades and site coverage expansion, and sustainment of analog to digital Project 25 (P25)[6] conversion, as well as planning for adoption of broadband and technology modernization. (Symons, 2014)

In 2004, the Wyoming Legislature created the Wyoming Public Safety Communications Commission (PSCC) to create a governance, policy, and planning structure to address the state's public safety requirements and interoperability issues as well as to develop standards for WyoLink (State of Wyoming, 2015a).

Statewide/Multi-County Public Safety Networks

WyoLink is the state's digital P25 statewide public safety network, which operates on VHF and 800 megahertz (MHz) and consists of a current tower network of 57 sites (Symons, 2014). In 2014, WyoLink was programmed to support 17,000 radios. It supports a range of public safety, state agency, and federal agency users, with 70 percent of usage driven by local county and city

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

[6] Project-25 (P25) is a suite of standards for digital radio communications for use by federal, state, and local public safety agencies in North America to enable them to communicate with other agencies and mutual aid response teams in emergencies.

agencies (Symons, 2014). Interoperability and Wyoming Mutual Aid is provided over WyoLink on VHF with 11 channels available; repeaters to support and mutual aid capabilities are operated by the Wyoming Highway Patrol (WHP) (RadioReference.com, 2015a). Figure 18.1.1-3 depicts the location of Wyoming's LMR repeater locations (State of Wyoming (WyoLink), 2015).

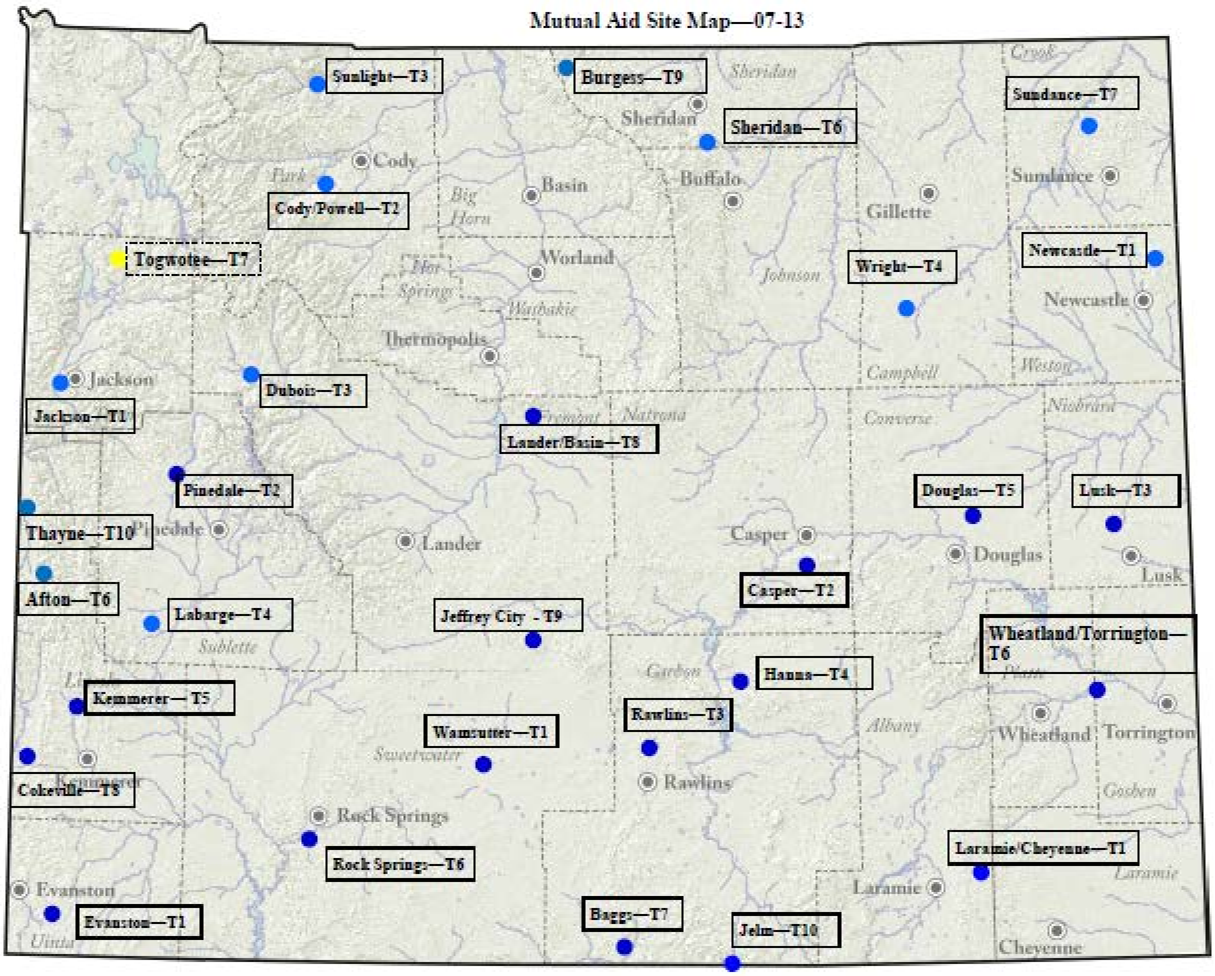


Figure 18.1.1-3: Wyoming Repeater Tower Locations

Source: (State of Wyoming (WyoLink), 2015)

WyoLink's LMR network provides the state's public safety users with very broad geographic coverage (green shading) as WyoLink also connects to Utah's neighboring statewide public safety LMR network, run by the Utah Communications Authority (UCA). (RadioReference.com, 2015b) Figure 18.1.1-4 below illustrates (State of Wyoming (WyoLink), 2015).

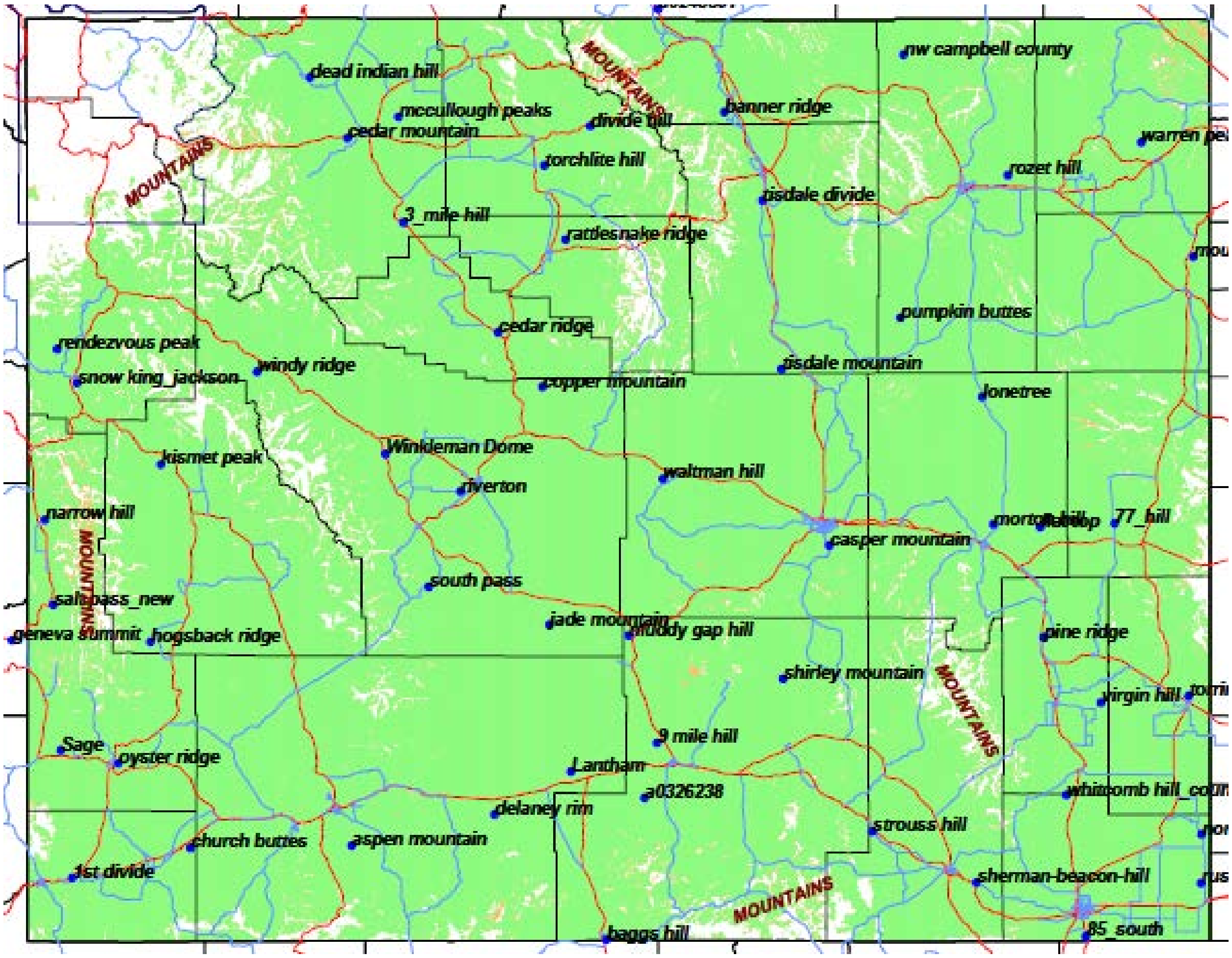


Figure 18.1.1-4: WyoLink Mobile Coverage

Source: (State of Wyoming (WyoLink), 2015)

County/City Public Safety Networks

Counties and cities in Wyoming are able to subscribe to WyoLink on a voluntary opt-in-basis, with an increasing number of counties and cities doing so. For example, in rural Sheridan County, public safety communications formerly resided on primarily legacy analog systems, whereas in 2014 the County upgraded to the digital P25 statewide system, WyoLink. The upgrade has produced voice emergency communication that is clearer, more reliable, and facilitates more effective interagency communications. (WyoLink, 2015)

In Laramie County, where the state capital, Cheyenne, is located, WyoLink's digital P25 VHF system is the primary communication system used by public safety agencies, including the sheriff, fire, and Emergency Medical Services (EMS) user groups, with existing analog legacy VHF communications reserved for backup (RadioReference.com, 2015c). In the city of Cheyenne, WyoLink is the primary network used by police and fire, as well as public works; and like Laramie County the conventional analog system provides backup service (RadioReference.com, 2015c). In Natrona County, where the city of Casper is located, the City of Casper's Public Safety 800 MHz network has been integrated with WyoLink (which supports both VHF and 800 MHz with its P25 technology), while the Natrona County Sheriff department continues to use the VHF system at 155 MHz for dispatch (RadioReference.com, 2015d).

Commercial Telecommunications Infrastructure

Wyoming'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 Wyoming'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

Wyoming'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 (BLS, 2016). Table 18.1.1-6 presents the number of providers of switched access[7] lines, Internet access[8], and mobile wireless services including coverage.

Table 18.1.1-6: Telecommunications Access Providers and Coverage (2013)

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access lines [a]	91	98.1% of households
Internet access [b]	34	49% of households
Mobile Wireless [c]	7	94% of population

[a] Switched access lines are a service connection between an end user and the local telephone company's switch (the basis of older telephone services); this number of service providers was reported by the FCC as of December 31, 2013 in Table 17 in "Local Telephone Competition: Status as of December 31, 2013" as the total of ILEC and non-ILEC providers (FCC, 2014b).
[b] Internet access providers are presented in Table 21 in "Internet Access Services: Status as of December 31, 2013" by technology provided; number of service providers is calculated by subtracting the reported Mobile Wireless number from the total reported number of providers (FCC, 2014a).
[c] Mobile wireless provider data is provided by the FCC in the sources identified. However, NTIA's National Broadband Map provides newer data, so FirstNet is using NTIA's GIS-based data from the National Broadband Map instead of the data reported by the FCC. The process for retrieving the National Broadband Map data is explained in detail in a subsequent footnote in Section 18.1.1.5, Last Mile Fiber Assets.

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

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

Table 18.1.1-7 shows the wireless providers in Wyoming along with their geographic coverage. The following three maps, Figure 18.1.1-5, Figure 18.1.1-6, and Figure 18.1.1-7 show the combined coverage for the top two providers (each of which covers the entire state), Union Wireless's coverage, and the coverage of all other providers with less than 5 percent coverage area, respectively.[9]

Table 18.1.1-7: Wireless Telecommunications Coverage by Providers in Wyoming

Wireless Telecommunications Providers	Coverage
Verizon Wireless	66.99%
AT&T Mobility Limited Liability Company (LLC)	52.51%
Union Wireless	21.02%
Other[a]	18.57%

Source: (NTIA, 2014)

[a] Other: Provider with less than 5 percent coverage area. Providers include: STRATA Networks; Wyoming.com; Vistabeam; Collins Communications, Inc.; Tri County Telephone (TCT) West, Inc.; T-Mobile; Mountain West Telephone; Sprint; Visionary Communications, Inc.; Millhouse Electronics Inc.; AllureTech/CoffeyNet; Skybeam; Silver Star Wireless; Rise Broadband; Network Generation Lifeline (NGL) Connection; Wind River Internet; Fiberpipe Internet; Fascinations; Advanced Communications Technology, Inc. (ACT); All West Communications; Sweetwater Cable TV; Celerity Networks, LLC.

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

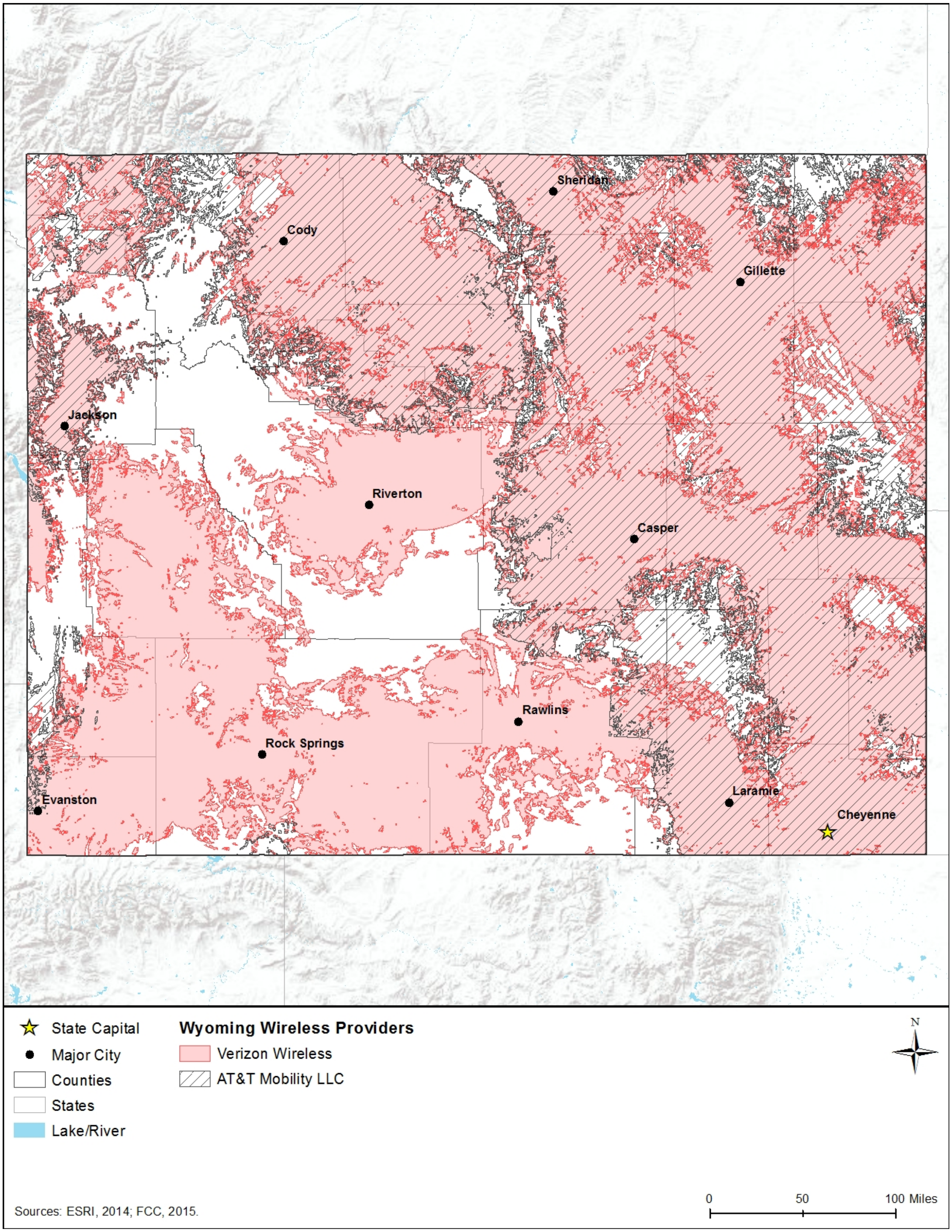


Figure 18.1.1-5: AT&T and Verizon Wireless Availability in Wyoming

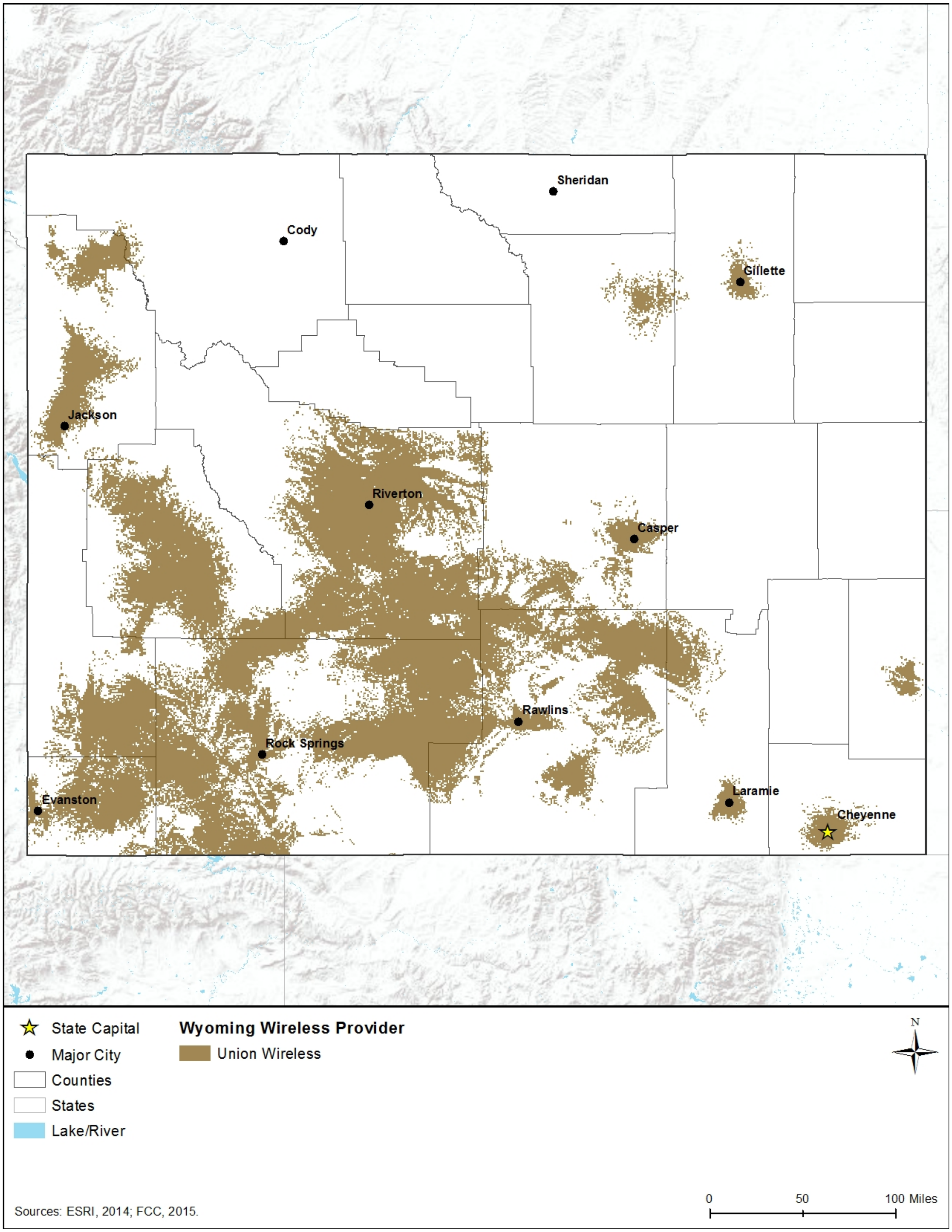


Figure 18.1.1-6: Union Wireless, Wireless Availability in Wyoming

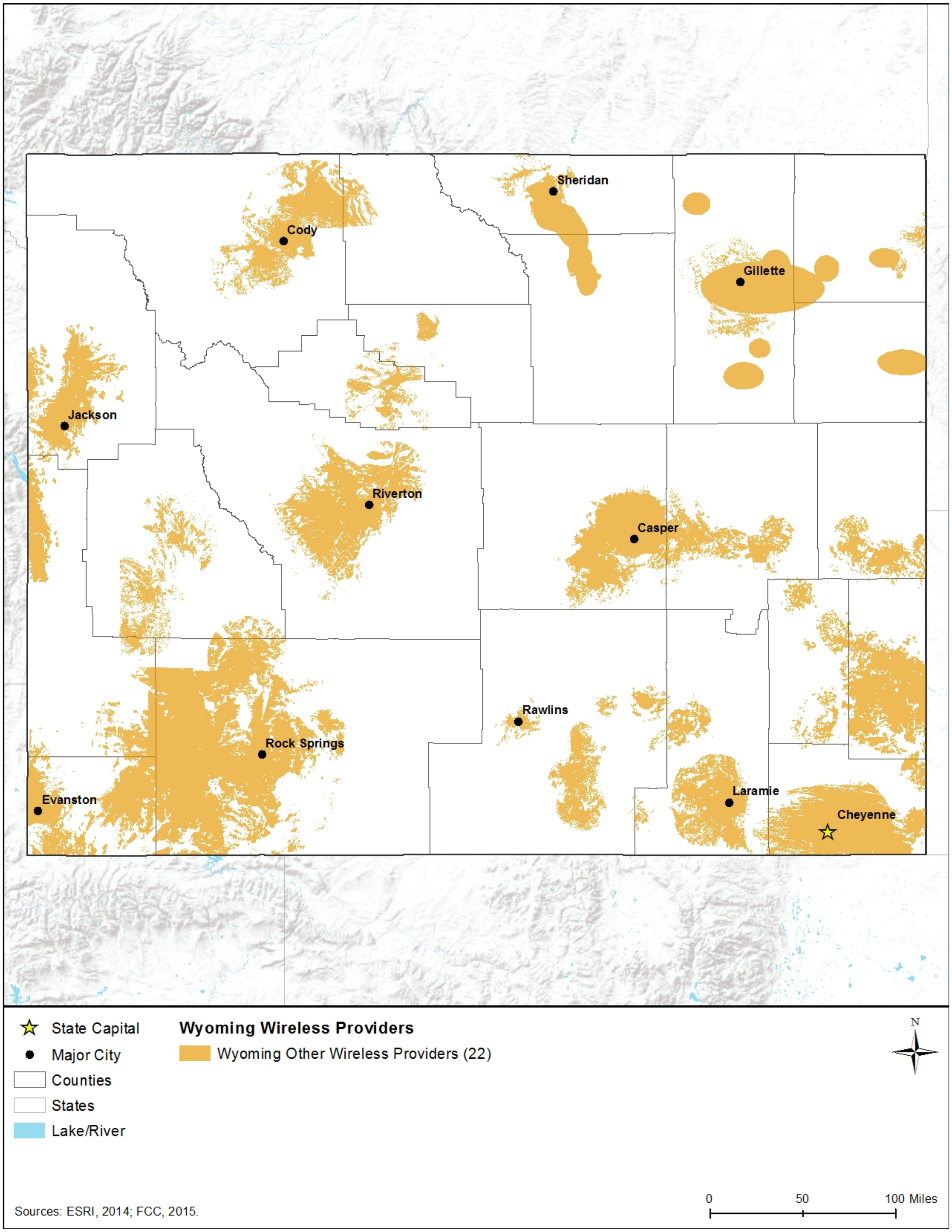


Figure 18.1.1-7: Other Providers Wireless Availability in Wyoming

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. Figure 18.1.1-8 presents representative examples of each of these categories or types of towers.

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

Lattice
200 – 400 feet
Source: Personal Picture

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

Figure 18.1.1-8: Types of Towers

Telecommunications tower infrastructure proliferates throughout Wyoming, although tower infrastructure is concentrated in the higher and more densely populated areas of Wyoming; Gillette, Sheridan, Cody, Casper, Riverton, Cheyenne, Laramie, Rawlins, Rock Springs, Evanston, and Jackson (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015b) (U.S. Census Bureau, 2015f). Owners of towers and some types of antennas are required to register those infrastructure assets with the Federal Communications Commission (FCC) (FCC, 2016b).[10] Table 18.1.1-8 presents the number of towers (including broadcast towers) registered with the

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

FCC in Wyoming, by tower type, and Figure 18.1.1-9 presents the location of those structures, as of June 2016.

Table 18.1.1-8: Number of Commercial Towers in Wyoming by Type

Constructed[a] Towers[b]		Constructed Monopole Towers	
100ft and over	32	100ft and over	0
75ft – 100ft	61	75ft – 100ft	0
50ft – 75ft	63	50ft – 75ft	0
25ft – 50ft	63	25ft – 50ft	7
25ft and below	76	25ft and below	8
Subtotal	**295**	**Subtotal**	**15**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	7	100ft and over	0
75ft – 100ft	15	75ft – 100ft	1
50ft – 75ft	11	50ft – 75ft	1
25ft – 50ft	5	25ft – 50ft	3
25ft and below	1	25ft and below	4
Subtotal	**39**	**Subtotal**	**9**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	6	100ft and over	0
75ft – 100ft	6	75ft – 100ft	0
50ft – 75ft	15	50ft – 75ft	0
25ft – 50ft	10	25ft – 50ft	0
25ft and below	2	25ft and below	0
Subtotal	**39**	**Subtotal**	**0**
Constructed Tanks[d]			
Tanks	0		
Subtotal	**0**		
Total All Tower Structures		**397**	

Source: (FCC, 2015)

[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, 2015).

[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).

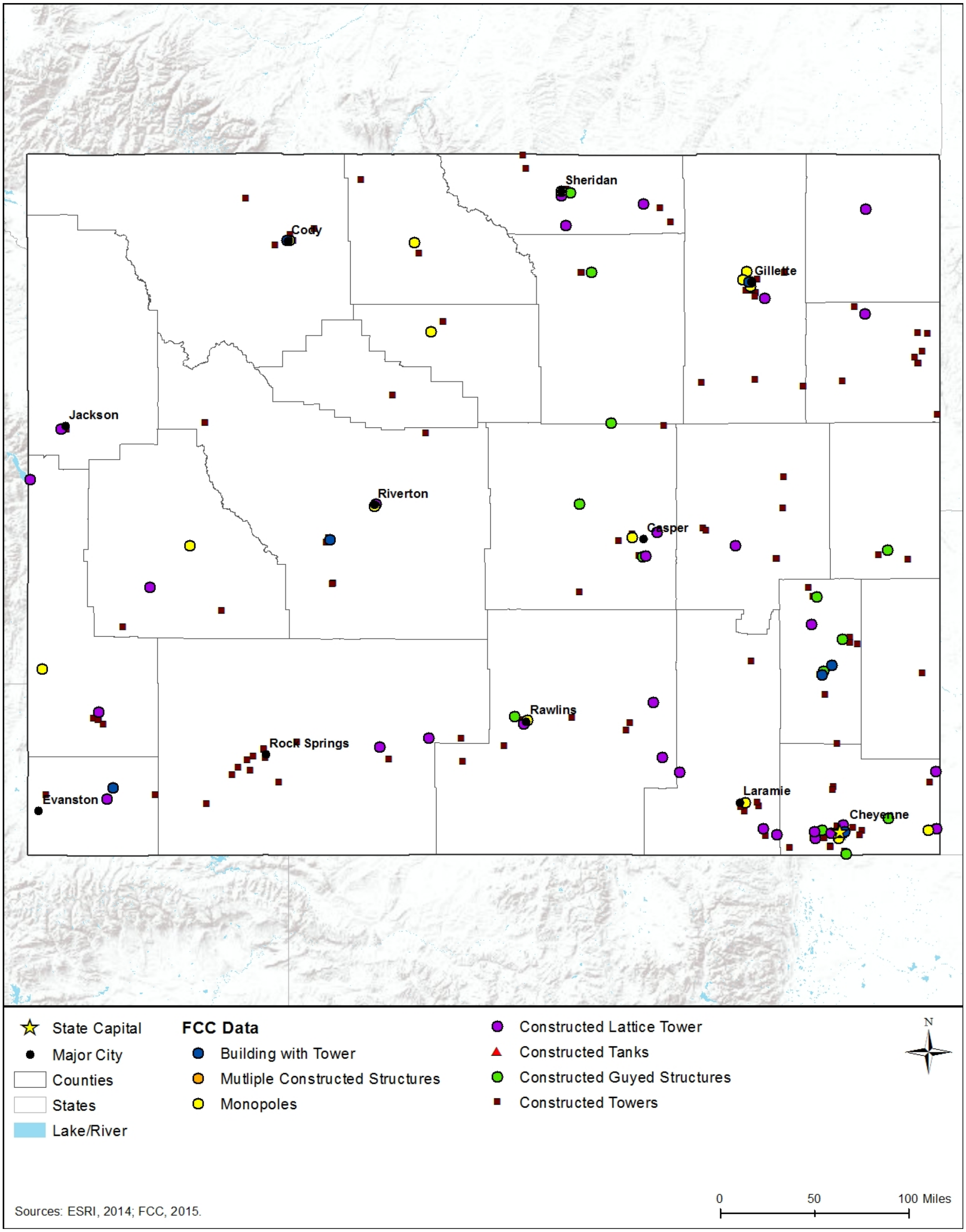
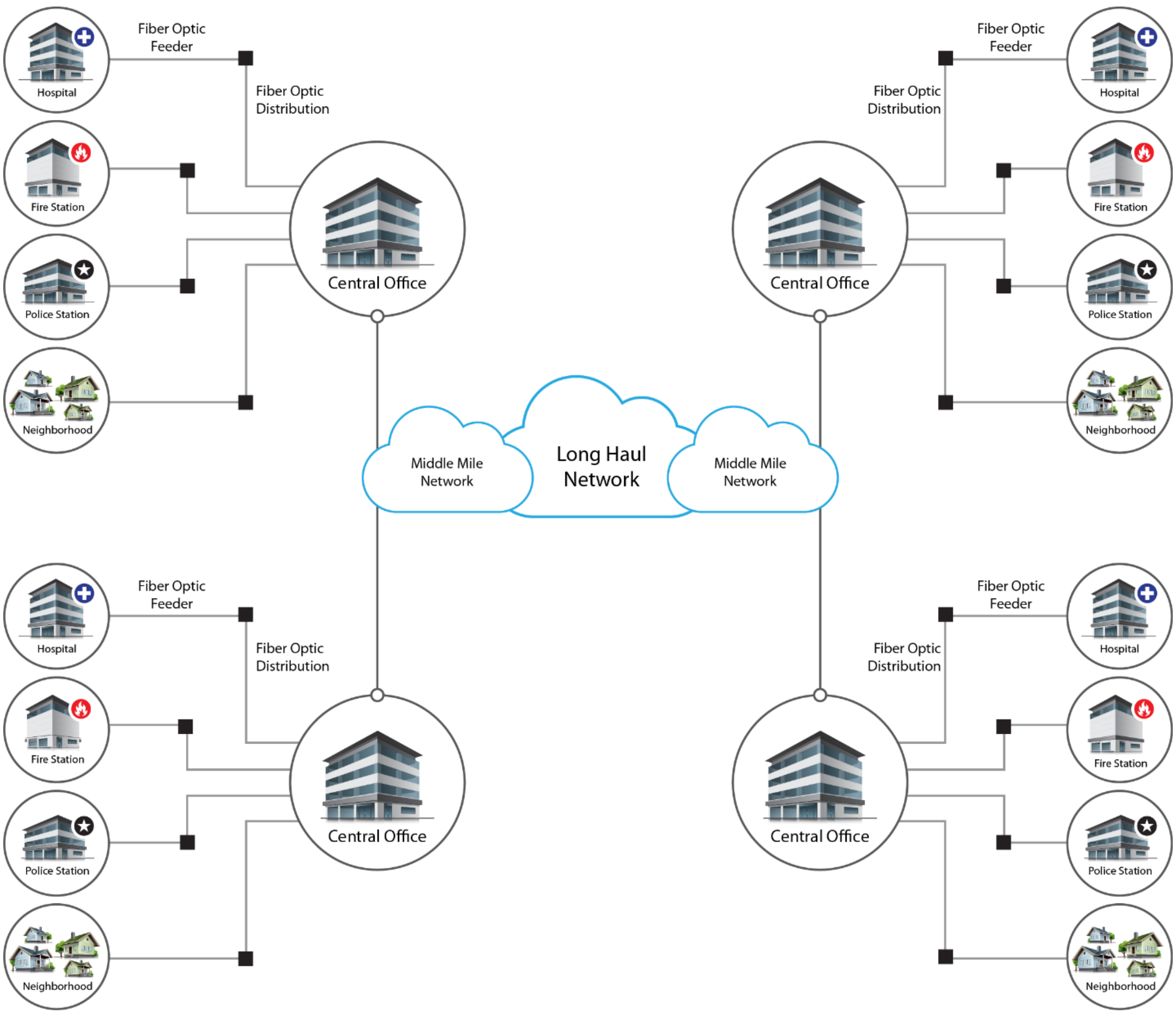


Figure 18.1.1-9: FCC Tower Structure Locations in Wyoming

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 18.1.1-10. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).



Prepared by: Booz Allen Hamilton

Source: (ITU, 2012)

Figure 18.1.1-10: Typical Fiber Optic Network in Wyoming

Last Mile Fiber Assets

In Wyoming, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Wyoming there are 20 fiber providers that offer service in the state, as listed in Table 18.1.1-9. Figure 18.1.1-11 shows coverage for Range Telephone (RT) Communications, Inc. and CenturyLink, and Figure 18.1.1-12 shows coverage area for all other fiber providers with less than 5 percent coverage area, respectively.

Table 18.1.1-9: Fiber Provider Coverage

Fiber Provider	Coverage
RT Communications, Inc.	1.51%
CenturyLink	1.00%
Other[a]	2.70%

Source: (NTIA, 2014)

[a] Other: Provider with less than 5 percent coverage area. Providers include: Windbreak Cable; Chugwater Telephone; Tongue River Cable TV, Inc.; Level 3 Communications, LLC; Vyve Broadband; ACT; Sweetwater Cable TV; Nemont; Wyoming.com; Visionary Communications, Inc.; Union Telephone; Silver Star Communications; All West Communications; Dubois Telephone Exchange, Inc. (DTE); Tri County Telephone Association, Inc.; TCT West, Inc.; Charter; Range Telephone Cooperative Inc.

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.

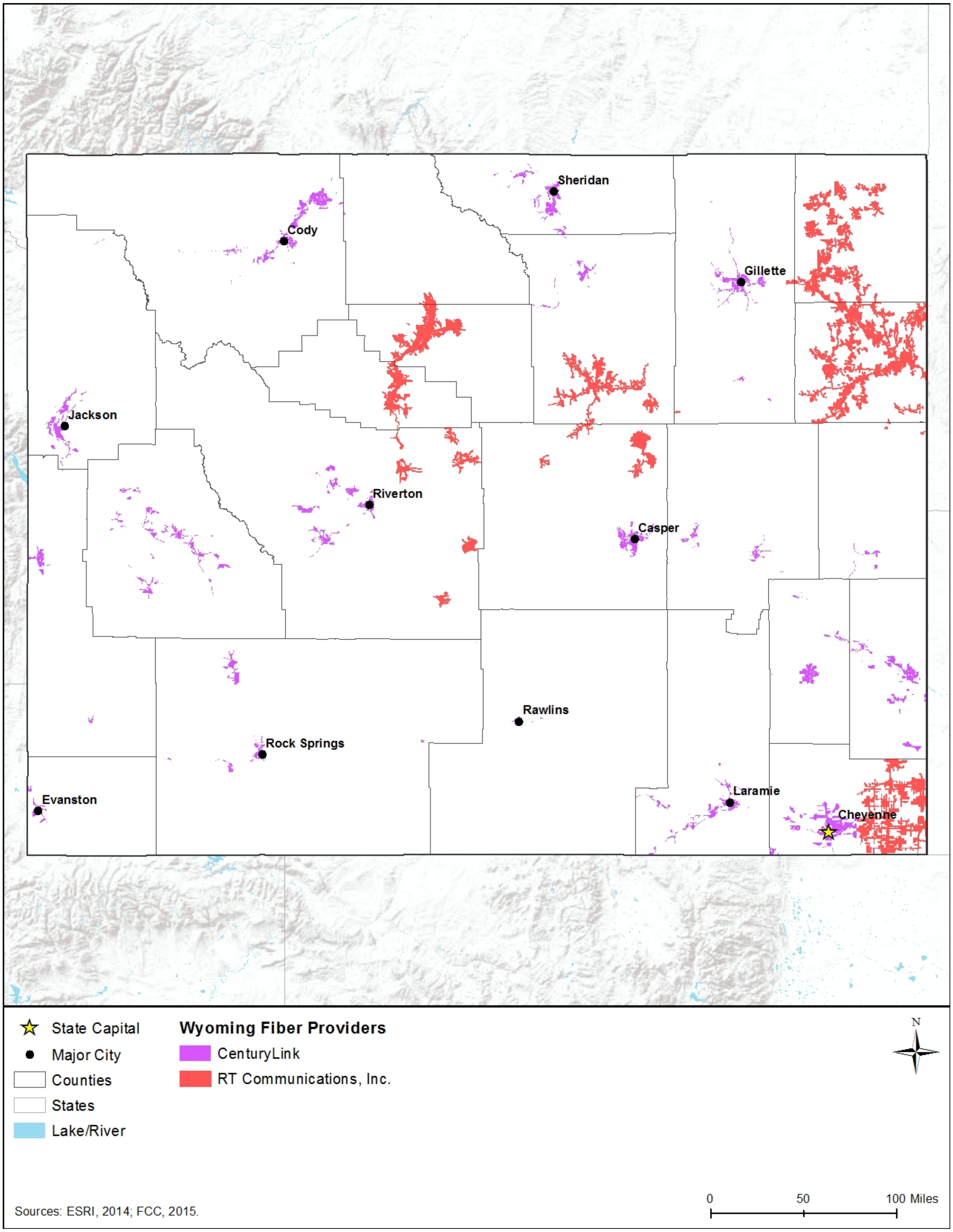


Figure 18.1.1-11: Fiber Availability in Wyoming for CenturyLink and RT Communications, Inc.

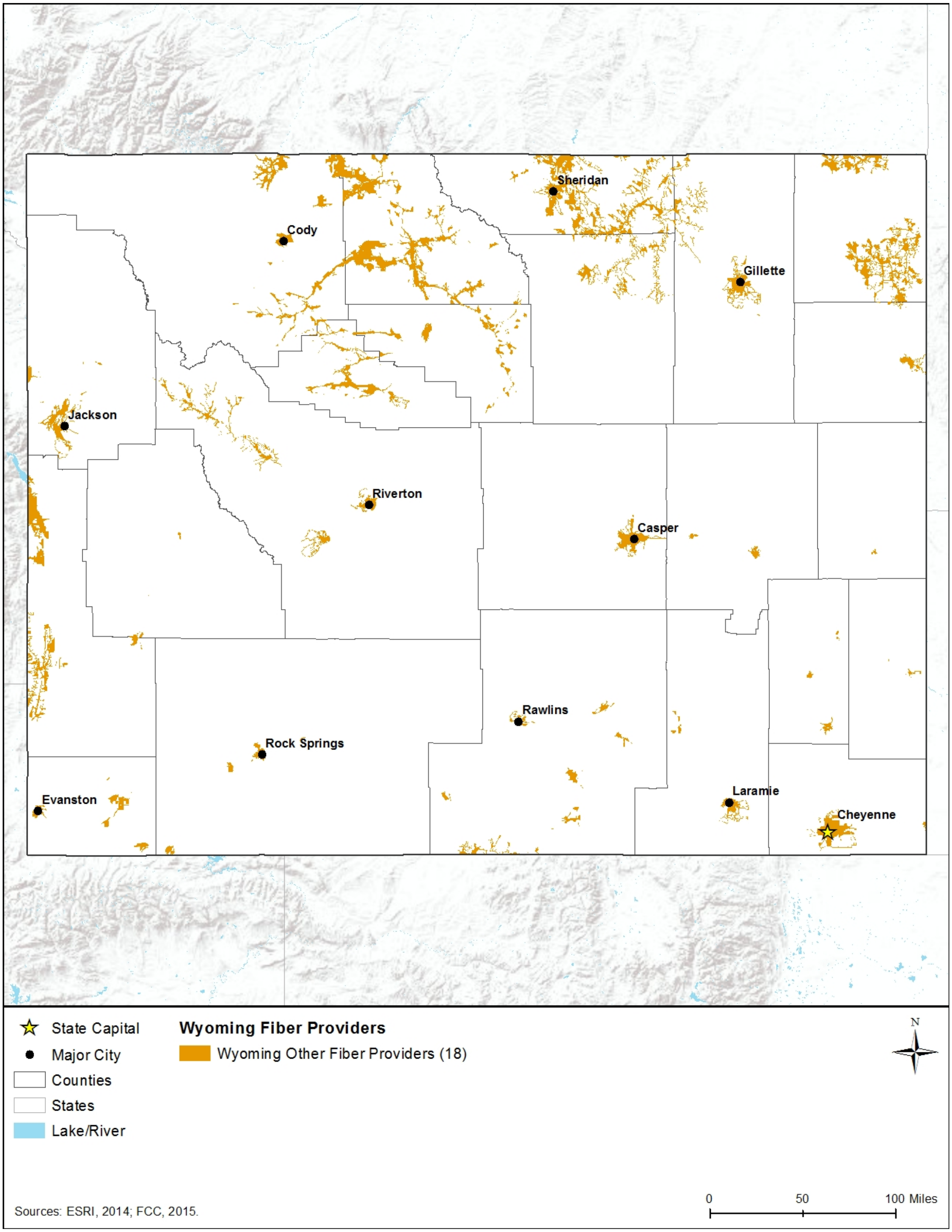


Figure 18.1.1-12: Other Providers Fiber Availability in Wyoming

18.1.1.6. 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 18.1.4, Water Resources, describes the potable water sources in the state.

Electricity

Both Wyoming's investor-owned electric utilities and its rural electric cooperatives (REC) have several aspects of their service overseen by the Public Service Commission (PSC). Along with other responsibilities, the PSC regulates utility rates and approves the construction and operation of power plants and transmission lines. In addition, they oversee some interactions between companies, such as mergers or other transactions. Four investor-owned utilities and eighteen RECs fall under their jurisdiction (PSC, 2015a). Nearly all of Wyoming's electricity comes from coal-powered generation plants (EIA, 2015a). In 2014, coal powered plants produced 43,408,651 megawatt-hours, 87 percent of the total 49,696,183 megawatt-hours in Wyoming.[11] Wind power makes up much of the remaining generation, accounting for 4,405,757 megawatt-hours (8.8 percent) in 2014. Petroleum liquid fuels, hydroelectric facilities and natural and other gasses all produced minimal amounts of power (EIA, 2015a). Coal has long been the primary source of electricity in Wyoming, with wind power overtaking hydroelectric power for second place in 2008. Wyoming's industrial sector accounts for the largest percentage of electricity consumption. In 2013, the industrial sector accounted for 58.1 percent of the state's electrical usage with the transportation, commercial and residential sectors accounting for just 21.1 percent, 11.7 percent and 9.1 percent, respectively (EIA, 2015b).

Water

The majority of Wyoming's populace receives their drinking water through services provided by their municipality or a local water district. A small number of people get their water through retail service providers. The eight retail providers in Wyoming have aspects of their service regulated by the PSC. As with electricity, the PSC approves utility rates and approves mergers or other transactions between companies (PSC, 2015b). While all other states in U.S. apply the Safe Drinking Water Act (SDWA) at a state level, the USEPA "directly implements the Safe Drinking Water Act in the state of Wyoming." The regulations required by the act cover public water system, defined as those with "15 or more service connections or that serve 25 or more persons for more than 60 days per year." There are 799 public water systems in the state, broken into three categories: community public water systems, transient non-community water systems and non-transient non-community public water systems. Community water systems account for 311 systems, transient non-community systems for 392 and non-transient non-community systems for 96 of the systems (USEPA, 2015a). Though the USEPA implements regulations of the SDWA, the Wyoming Department of Environmental Quality (WDEQ) runs the operator certification program through which facility operators are approved (WDEQ, 2015a). The

[11] One megawatthour is defined as "one thousand kilowatt-hours or 1 million watt-hours." One watt-hour 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, 2016c)

USEPA produces an annual report on Wyoming water system regulatory compliance. Among other things, these reports detail violations relating to contaminants in the water (USEPA, 2015b).

Wastewater

Discharge of polluted water into surface water in Wyoming is regulated under the Federal Clean Water Act (CWA). Operators of facilities that discharge pollutants must first obtain a Wyoming Pollutant Discharge Elimination System (WPDES) Permit from the WDEQ. These permits contain limitations and regulations designed to help keep the state's surface water clean (WDEQ, 2015b). Surface water is used as a source for drinking water for 17 percent of the state's public water systems making the protection of this water is paramount (USEPA, 2015a). The WDEQ offers several types of permits, including those for pesticide use or the discharge of storm waters (WDEQ, 2015b). Small onsite wastewater systems, such as septic tanks, must also obtain permits from the WDEQs Water and Wastewater Program, while large systems that handle more than 2,000 gallons/day must be permitted through the Underground Injection Control Program (WDEQ, 2015c). While permits must be obtained for facilities to discharge, the operators of these facilities must also be certified. The WDEQ offers certification training for both new and experienced operators (WDEQ, 2015a).

Solid Waste

Solid Waste Management in Wyoming is overseen by the WDEQ. Among their responsibilities, the WDEQ issues permits allowing the operation of facilities, and aids the construction of new facilities (WDEQ, 2015d). Recent discoveries of landfill waste leaking from unlined landfills into the groundwater prompted the WDEQ to prioritize and aid the movement of waste from small community landfills to larger regional ones (WDEQ, 2015e). State funds were appropriated for the movement of 47 projects related to the task (Wyoming Senate, 2015). It is also the responsibility of the WDEQ to permit the "location, design, construction, operation, monitoring, closure, and post-closure care of solid waste treatment, storage, and disposal facilities" (WDEQ, 2015f). A study conducted in 2013 found a recycling rate in 2010 of 7 percent along with a composting rate of 8 percent. By 2013 the recycling rate had been raised to 15 percent, with recommendations that would help raise it to 30 percent. These recommendations included the centralization or regionalizing recycling programs (WDEQ, 2015g).

18.1.2. Soils

18.1.2.1. Definition of the Resource

The Soil Science Society of America defines soil as:

(i) "The unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants." (NRCS, 2015a)

(ii) "The unconsolidated mineral or organic matter on the surface of the Earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including

> water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics." (NRCS, 2015a)

Five primary factors account for soil development patterns. A combination of the following variables contributes to the soil type in a particular area (University of Minnesota, 2001):

- *Parent Material*: The original geologic source material from the soil formed affects soil aspects, including color, texture, and ability to hold water.
- *Climate*: Chemical changes in parent material occur slowly in low temperatures. However, hot temperatures evaporate moisture, which also facilitates chemical reactions within soils. The highest degree of reaction within soils occurs in temperate, moist climates.
- *Topography*: Steeper slopes produce increased runoff, and, therefore, downslope movement of soils. Slope orientation also dictates the microclimate to which soils are exposed, because different slope faces receive more sunlight than others.
- *Biology*: The presence/absence of vegetation in soils affects the quantity of organic content of the soil.
- *Time*: Soil properties are dependent on the period over which other processes act on them.

18.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. Applicable federal laws and regulations that apply for Soils, such as the Farmland Protection Policy Act of 1981, are in Section 1.8, Overview of Relevant Federal Laws and Executive Orders. A list of applicable state laws and regulations is included in Table 18.1.2-1 below.

Table 18.1.2-1: Relevant Wyoming Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Wyoming Water Quality Rules and Regulations Chapter 2	Wyoming Department of Environmental Quality (WDEQ)	Erosion and sediment controls are required for construction activities disturbing one acre or more, as part of the storm water permit program under the Wyoming Pollutant Discharge and Elimination System (WPDES) program.

18.1.2.3. *Environmental Setting*

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

- Central Great Plains Winter Wheat and Range Region,
- Rocky Mountain Range and Forest Region,
- Western Great Plains Range and Irrigated Region, and
- Western Range and Irrigated Region.

"Within and among Wyoming's four LRRs are 16 Major Land Resource Areas (MLRA),[13] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (NRCS, 2006)." The locations and characteristics of Wyoming's MLRAs are presented in Figure 18.1.2-1 and Table 18.1.2-2, respectively.

Soil characteristics are an important consideration for FirstNet insomuch as soil properties could influence the suitability of sites for network deployment. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, elevation and position on the landscape, biota such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[14] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky, & Rogers, 2004). Soils can also be affected by a variety of surface uses that loosen topsoil and damage or remove vegetation or other groundcover, which may result in accelerated erosion, compaction, and rutting[15] (discussed further in the subsections below).

[12] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (NRCS, 2006).
[13] Major Land Resource Area: "A geographic area, usually several thousand acres in extent, that is characterized by a particular pattern of soils, climate, water resources, land uses, and type of farming" (NRCS, 2006).
[14] 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).
[15] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009c).

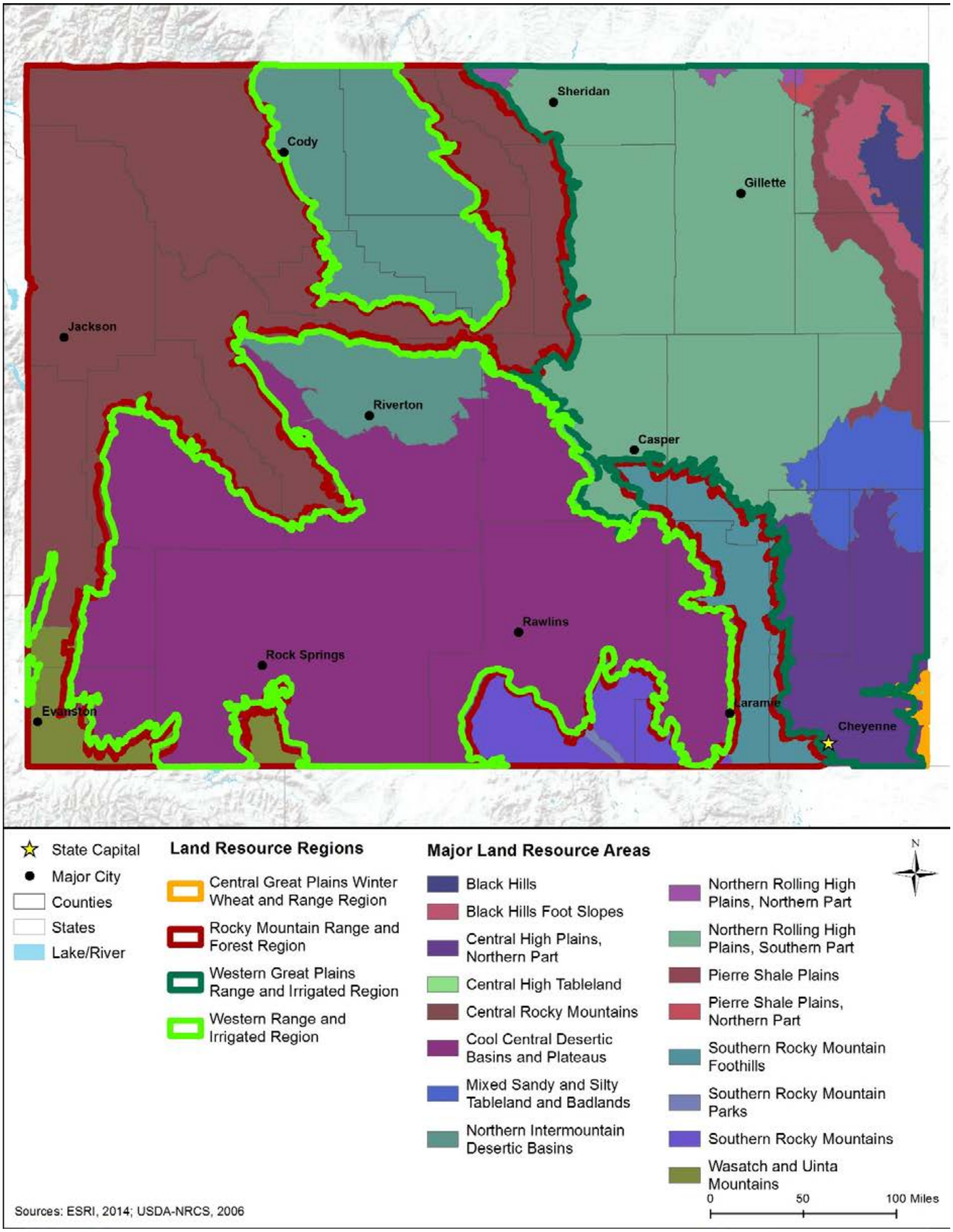


Figure 18.1.2-1: Locations of Major Land Resource Areas in Wyoming

Table 18.1.2-2: Characteristics of Major Land Resource Areas in Wyoming

MLRA Name	Region of State	Soil Characteristics
Black Hills	Eastern Wyoming	Alfisols[16] and Mollisols[17] are the dominant soil orders. These clayey or loamy[18] soils are typically well drained and range from shallow to very deep.
Black Hills Foot Slopes	Eastern Wyoming	Alfisols, Entisols,[19] and Mollisols are the dominant soil orders. These loamy soils are typically well drained and range from shallow to very deep.
Central High Plains, Northern Part	Southeastern Wyoming	Entisols and Mollisols are the dominant soil orders. These soils are typically sandy or loamy and range from shallow to moderately deep. They range from well drained (mostly) to poorly drained.
Central High Tableland	Southeastern Wyoming	Entisols and Mollisols are the dominant soil orders. These typically very deep soils are moderately well drained to excessively drained and vary in texture.
Central Rocky Mountains	Western Wyoming	Alfisols, Inceptisols,[20] and Mollisols are the dominant soil orders. These soils are medium to coarse textured, and are typically skeletal.
Cool Central Desertic Basins and Plains	Southern Wyoming	Aridisols[21] and Entisols are the dominant soil orders. These typically well drained soils are "shallow or moderately deep to shale or sandstone bedrock."
Mixed Sandy and Silty Tableland and Badlands	Eastern Wyoming	Entisols, Inceptisols, and Mollisols are the dominant soil orders. These sandy or loamy soils are typically well drained or somewhat excessively drained. They range from shallow to very deep.
Northern Intermountain Desertic Basins	Northern Wyoming	Aridisols and Entisols are the dominant soil orders. These loamy soils are well drained and typically range from shallow to very deep.
Northern Rolling High Plains, Northern Part	Northern Wyoming	Entisols and Inceptisols are the dominant soil orders. These loamy or clayey soils are well drained and typically range from shallow to very deep.
Northern Rolling High Plains, Southern Part	Northeastern Wyoming	Aridisols and Entisols are the dominant soil orders. These loamy or clayey soils are typically well drained. They range from shallow to very deep.

[16] Alfisols: "Soils found in semiarid to moist areas that are formed from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil. They are productive for most crop, are primarily formed under forest or mixed vegetative cover, and make up nearly 10 percent of the world's ice-free land surface." (NRCS, 2015b)

[17] 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." (NRCS, 2015b)

[18] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts." (Purdue University Consumer Horticulture, 2006)

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

[20] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates, and make up nearly 17 percent of the world's ice-free land surface." (NRCS, 2015b)

[21] 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." (NRCS, 2015b)

MLRA Name	Region of State	Soil Characteristics
Pierre Shale Plains	Eastern Wyoming	Alfisols, Entisols, Inceptisols, and Vertisols[22] are the dominant soil orders. These clayey soils are typically well drained and range from shallow to very deep.
Pierre Shale Plains, Northern Part	Northeastern Wyoming	Alfisols, Entisols, and Vertisols are the dominant soil orders. These clayey soils range from shallow to very deep, and are typically well drained.
Southern Rocky Mountain Foothills	Southern Wyoming	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These soils are generally well drained and loamy or clayey. They range from very shallow to very deep.
Southern Rocky Mountain Parks	Southern Wyoming	Mollisols is the dominant soil order, with Alfisols less so. These typically well drained soils range from very shallow to very deep, and are loamy or clayey.
Southern Rocky Mountains	Southern Wyoming	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders.
Wasatch and Uinta Mountains	Southwestern Wyoming	Aridisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These typically well drained soils range from very shallow to very deep and are loamy or loamy-skeletal.

Source: (NRCS, 2006)

18.1.2.4. 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[23]; there are twelve soil orders in the world and they are characterized by both observed and inferred[24] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (NRCS, 2015c). The STATSGO2[25] soil database identifies 13 different soil suborders in Wyoming (NRCS, 2015d). Figure 18.1.2-2 depicts the distribution of the soil suborders, and Table 18.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[22] Vertisols: "Vertisols have a high content of expanding clay minerals. They undergo pronounced changes in volume with changes in moisture, and have cracks that open and close periodically, and that show evidence of soil movement. Vertisols transmit water very slowly, have undergone little leaching, and tend to be high in natural fertility. They make up about 2 percent of the world's ice-free land surface." (NRCS, 2015b)

[23] Science of naming and classifying organisms or specimens.

[24] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)." (NRCS, 2015e)

[25] State Soil Geographic (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 STATSGO dataset.

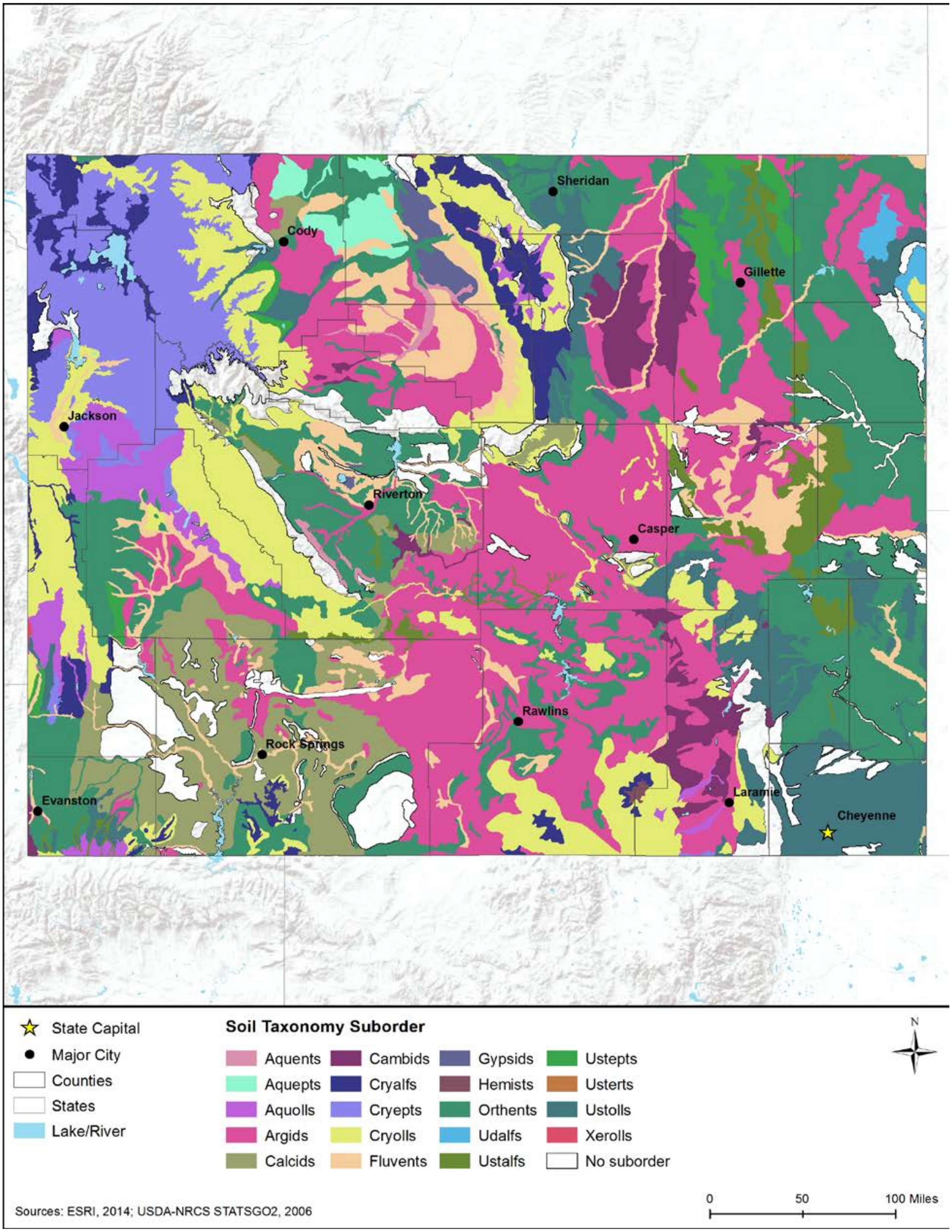


Figure 18.1.2-2: Wyoming Soil Taxonomy Suborders

Table 18.1.2-3: Major Characteristics of Soil Suborders[26] Found in Wyoming, as depicted in Figure 18.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[27]	Hydrologic Group	Runoff Potential	Permeability[28]	Erosion Potential	Compaction and Rutting Potential	Limitation for Construction
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.	Loam, Sandy loam	0-6	Somewhat poorly drained	No	B, C	Medium	Moderate, Low	Medium	Low	Erosion
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage. If these soils have not been artificially drained, ground water 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.	Stratified fine sandy loam to loam	0-3	Somewhat poorly drained	Yes	C	Medium	Low	Medium	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
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, Fine sandy loam, Loam, Sandy loam, Silt loam, Variable, Very gravelly loamy sand	0-4	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	Erosion and Compaction
Aridisols	Argids	Argids are found in the western United States. They are primarily used as wildlife habitat or rangeland, although some can also be used as cropland, if irrigated.	Clay, Clay loam, Coarse sandy loam, Extremely gravelly sand, Fine sandy loam, Gravelly clay loam, Gravelly sandy clay loam, Loam, Sandy clay loam, Sandy loam, Silt loam, Silty clay loam, Stratified loamy sand to fine sandy loam, Unweathered bedrock, Very cobbly sandy clay loam, Very gravelly clay loam, Very gravelly loam, Very gravelly loamy sand, Very gravelly sand	0-35	Moderately well drained to somewhat excessively drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low	Erosion
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.	Extremely cobbly sand, Fine sandy loam, Gravelly loam, Gravelly silt loam, Loam, Sandy clay loam	0-50	Well drained to somewhat excessively drained	No	B, C	Medium	Moderate, Low	Medium	Low	Erosion
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, Clay loam, Loam, Unweathered bedrock	0-30	Well drained	No	B, C	Medium	Moderate, Low	Medium	Low	Erosion

[26] 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.
[27] Hydric Soil: "A soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part." (NRCS, 2015f) Soil suborders constitute a broad range of soil types. Within each soil suborder, some specific soil types are hydric while others are not.
[28] Based on Runoff Potential, described in 18.1.2.5.

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[27]	Hydrologic Group	Runoff Potential	Permeability[28]	Erosion Potential	Compaction and Rutting Potential	Limitation for Construction
Alfisols	Cryalfs	Cryalfs are cold weather soils found primarily at high elevations. Due to the cold, short growing season, the majority of these soils are utilized as forest.	Channery sandy clay loam, Clay loam, Gravelly sandy loam, Gravelly silt loam, Loam, Sandy clay loam, Silt loam, Very channery sandy clay loam, Very cobbly clay loam, Very gravelly loam, Very stony sandy clay loam	2-60	Somewhat poorly drained to well drained	No	B, C	Medium	Moderate, Low	Medium	Low	Erosion
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.	Cobbly sandy loam, Extremely channery loam, Extremely flaggy loam, Extremely flaggy sandy, loam, Fine sandy loam, Loam, Sandy loam, Unweathered bedrock, Very channery sandy loam, Very gravelly loam	3-70	Well drained to excessively drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low	Erosion
Mollisols	Cryolls	Cryolls are generally freely drained, cold weather soils. They are primarily used as rangeland, along with some forest and pasture. Forest, grass, or grass/shrub vegetation are supported with these soils.	Channery clay, Channery loam, Clay loam, Cobbly very fine sandy loam, Extremely cobbly silty clay loam, Fine sandy loam, Gravelly loam, Gravelly sandy loam, Loam, Sandy clay loam, Silt loam, Silty clay loam, Stratified very gravelly sand to sandy clay loam, Unweathered bedrock, Very cobbly loam, Very fine sandy loam, Very gravelly loam, Very gravelly loamy sand, Very gravelly sandy loam, Very stony clay loam	0-60	Moderately well drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low	Erosion

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[27]	Hydrologic Group	Runoff Potential	Permeability[28]	Erosion Potential	Compaction and Rutting Potential	Limitation for Construction
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.	Clay loam, Fine sandy loam, Loam Loamy fine sand, Sand, Sandy clay loam, Silty clay loam, Stratified fine sandy loam to clay, Stratified fine sandy loam to clay loam, Stratified loamy fine sand to loam, Stratified loamy sand to sandy clay loam, Stratified sand to loamy fine sand, Stratified very fine sandy loam to clay loam, Very gravelly loamy sand, Very gravelly sand	0-8	Poorly drained to somewhat excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low	Erosion
Aridisols	Gypsids	Gypsids are soils with a petrogypsic or gypsic horizon. These soils have limited uses, and are predominantly utilized for wildlife habitat or rangeland.	Loam, Sandy loam	0-10	Well drained	No	B	Medium	Moderate	Medium	Low	Erosion
Histosols	Hemists	Hemists are usually found in broad, flat areas, such as coastal plains and outwash plains as well as closed depressions. They are typically under natural vegetation and uses for rangeland, woodlands, and/or wildlife habitat, although some large areas have been cleared and drained, and utilized for cropland.	Mucky peat	0-6	Well drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Bedrock, Clay, Clay loam, Extremely gravelly loam, Fine sandy loam, Fragmental material, Gravelly loam, Loam, Loamy coarse sand, Loamy very fine sand, Sandy loam, Silt loam, Silty clay, Silty clay loam, Stratified fine sandy loam to silty clay loam, Unweathered bedrock, Very channery sandy loam, Very gravelly loam, Weathered bedrock	0-75	Moderately well drained to somewhat excessively drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low	Erosion
Alfisols	Udalfs	Udalfs have an udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Extremely gravelly clay loam	6-60	Well drained	No	B	Medium	Moderate	Medium	Low	Erosion
Alfisols	Ustalfs	Ustalfs are primarily used for grazing or cropland, and they also support savanna and grassland vegetation. They are found in areas with a marked dry season.	Clay, Clay loam, Extremely flaggy loam, Loam, Unweathered bedrock	0-30	Moderately well drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low	Erosion
Inceptisols	Ustepts	Ustepts are freely drained soils, typically used as pasture or cropland, although some support forest, rangeland, and wildlife habitat.	Extremely gravelly sandy loam, Loam, Silty clay loam, Stratified loamy sand to gravelly loam, Very channery loam, Very gravelly loamy sand	0-40	Well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low	Erosion

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[27]	Hydrologic Group	Runoff Potential	Permeability[28]	Erosion Potential	Compaction and Rutting Potential	Limitation for Construction
Vertisols	Usterts	Usterts are soils with low permeability, and receive low rainfall amounts. They support grasses and forbs, and are mostly used for rangeland or cropland. However, but due to their low permeability, they typically need to be artificially drained if irrigated, to prevent standing water and a buildup of salinity.	Clay	2-15	Well drained	No	D	High	Very Low	High	Low	Erosion
Mollisols	Ustolls	Ustolls typically supported grass and forest vegetation, and are now primarily used as cropland or rangeland. They are generally freely drained, and found in subhumid to semiarid climates. Areas with drought are common, and blowing soil can be an issue.	Clay loam, Fine sandy loam, Gravelly clay loam, Gravelly sand, Gravelly sandy loam, Loam, Loamy fine sand, Loamy very fine sand, Sandy clay loam, Sandy loam, Silt loam, Silty clay loam, Unweathered bedrock, Very channery sandy loam, Very cobbly loam, Very fine sandy loam, Very gravelly loam, Very gravelly sand, Very gravelly sandy loam, Weathered bedrock	0-60	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	Erosion
Mollisols	Xerolls	Xerolls are found on sloping lands with 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.	Very gravelly clay loam	1-4	Well drained	No	B	Medium	Moderate	Medium	Low	Erosion

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

18.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[29] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 18.1.2-3 (above) provides a summary of the runoff potential for each soil suborder in Wyoming.

Group A. **Sand, loamy sand or sandy loam soils.** This group of soils has "low runoff potential and high infiltration rates[30] 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). Fluvents and Ustolls fall into this category in Wyoming.

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. Aquents, Argids, Calcids, Cambids, Cryalfs, Cryepts, Cryolls, Fluvents, Gypsids, Orthents, Udalfs, Ustalfs, Ustepts, Ustolls, and Xerolls fall into this category in Wyoming.

Group C. **Sandy clay loam soils.** This group of soils has "low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure" (Purdue University, 2015). This group has medium runoff potential. Aquents, Aquepts, Aquolls, Argids, Calcids, Cambids, Cryalfs, Cryepts, Cryolls, Fluvents, Orthents, Ustalfs, Ustepts, and Ustolls fall into this category in Wyoming.

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). Aquolls, Argids, Cryepts, Cryolls, Fluvents, Hemists, Orthents, Ustalfs, Ustepts, Usterts, and Ustolls fall into this category in Wyoming.

18.1.2.6. Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015g). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a

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[29] 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

[30] 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)

public safety hazard (NRCS, 1996a). Table 18.1.2-3 (above) provides a summary of the erosion potential for each soil suborder in Wyoming. Soils with medium to high erosion potential in Wyoming include those in the Aquents, Aquepts, Aquolls, Argids, Calcids, Cambids, Cryalfs, Cryepts, Cryolls, Fluvents, Gypsids, Hemists, Orthents, Udalfs, Ustalfs, Ustepts, Usterts, Ustolls, and Xerolls suborders, which are found throughout the state (Figure 18.1.2-2).

18.1.2.7. Soil Compaction and Rutting

Soil compaction and rutting occurs when soil layers are compressed by machinery or animals, which decreases both open spaces in the soil, as well as water infiltration rates (NRCS, 1996b). Moist soils with high soil water content are most susceptible to compaction and rutting, as they lack the strength to resist deformation caused by pressure. When rutting occurs, channels form and result in downslope erosion (USFWS, 2009). Other characteristics that factor into compaction and rutting risk include soil composition (i.e. low organic soil is at increased risk of compaction), amount of pressure exerted on the soil, and repeatability (i.e., the number of times the pressure is exerted on the soil). Machinery and vehicles that have axle loads greater than ten tons can cause soil compaction of greater than 12 inches depth (NRCS, 1996b), (NRCS, 2003).

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS, 1996b). Table 18.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Wyoming Soils with the highest potential for compaction and rutting in Wyoming include those in the Aquepts, Aquolls, and Hemists suborders, which are found generally in north-central and western Wyoming (Figure 18.1.2-2). These soils constitute approximately 3.27 percent of Wyoming land area,[31] and are found across the state.

18.1.3. Geology

18.1.3.1. 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 Programmatic Environmental Impact Statement (PEIS), including Water Resources (Section 18.1.4), Human Health and Safety (Section 18.1.15), and Climate Change (Section 18.1.14).

[31] 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.

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

- Section 18.1.3.3, Environmental Setting: Physiographic Regions[32] and Provinces[33]
- Section 18.1.3.4, Surface Geology
- Section 18.1.3.5, Bedrock Geology[34]
- Section 18.1.3.6, Paleontological Resources[35]
- Section 18.1.3.7, Fossil Fuel and Mineral Resources
- Section 18.1.3.8, Geologic Hazards[36]

18.1.3.2. 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 18.1.3-1.

Table 18.1.3-1: Relevant Wyoming Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Wyoming Division Of State Parks & Historic Sites Rules and Regulations Chapter 1 Section 15	Wyoming Department of State Parks and Cultural Resources	Any disturbance, removal, destruction, injury, or defacement of prehistoric features can only be carried out with prior permission by the park superintendent.
Building Codes; examples such as (City of Gillette, 2014) (City of Cheyenne -- Building Safety Department, 2014)	Local Agencies	Check county, city, and other local agencies for seismic guidelines in building codes.

18.1.3.3. Environmental Setting: Physiographic Regions and Provinces

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

Wyoming is within two physiographic regions: Interior Plains (Great Plains Province) and Rocky Mountain System (Middle Rocky Mountains, Northern Rocky Mountains, Southern Rocky Mountains, and Wyoming Basin) (USGS, 2003a) (Figure 18.1.3-1).

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[32] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology (Fenneman, 1916).
[33] Physiographic provinces: Subsets within physiographic regions (Fenneman, 1916).
[34] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015f).
[35] Paleontology: “Study of life in past geologic time based on fossil plants and animals” (USGS, 2015g).
[36] 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).

Interior Plains Region

The Interior Plains Region extends across much of the interior of the United States, roughly between the western edge of the Appalachian Highlands (near states including Ohio, Tennessee, and Alabama), and the eastern edge of the Rocky Mountain System (including states such as Montana, Wyoming, and Colorado) (Fenneman, 1916). Metamorphic and igneous rocks dating to the Precambrian Era (older than 542 million years ago (MYA)) underlie the entire region.[37] There is minimal topographic relief throughout the region, except for the Black Hills of South Dakota. During the Mesozoic Era, much of the Interior Plains were covered by the oceans, resulting in the formation of sedimentary rocks,[38] which lie on top of the Precambrian basement rocks. Erosion from the Rocky Mountains to the west and the Ozark/Ouachita Mountains to the east, also contributed to the formation of sandstone,[39] mudstone,[40] and clay (USGS, 2014a).

Great Plains Province – The Great Plains Province includes more than 450,000 square miles in the United States and encompasses the western portion of the Interior Plains Region. The Great Plains, which are the second largest physiographic province in the United States, are noted for their flat topography that is interrupted by the occasional hill or lowland. (USGS, 2003a) (NPS, 2014a)

Within Wyoming, the Great Plains includes the portion of the state east of the Rocky Mountains. Elevations rise moving to the west throughout this physiographic province and reach 5,000 to 6,000 feet above sea level (ASL) at the base of the Rocky Mountains (Keefer, 1974). A unique feature of the Great Plains in Wyoming is the Black Hills section, “a huge, elliptically domed area in [northeastern Wyoming].” Erosion of sedimentary rocks has revealed granite and metamorphic rocks that form the core of the Black Hills (Trimble, 1980). The Black Hills reach roughly 7,000 feet ASL at their highest elevations (Keefer, 1974) and are roughly 3,000 to 4,000 feet above the surrounding landscape in some locations (Trimble, 1980).

[37] 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.
[38] Sedimentary Rock: “Rocks that formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding.” (USGS, 2014g)
[39] Sandstone: “Sedimentary rock made mostly of sand-sized grains.” (USGS, 2015e)
[40] Mudstone: “A very fine-grained sedimentary rock formed from mud.” (USGS, 2015e)

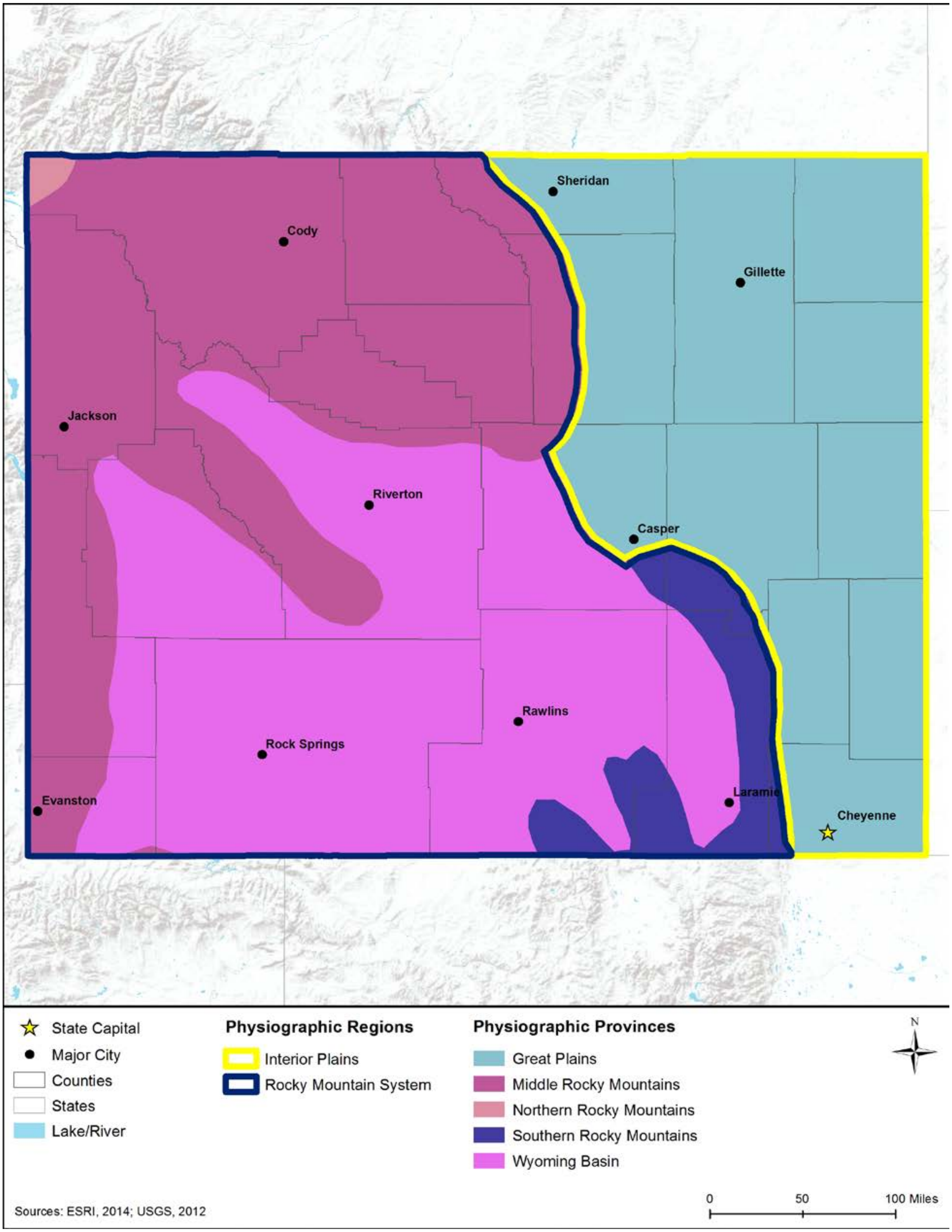


Figure 18.1.3-1: Physiographic Regions, Provinces, and Sections of Wyoming

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,[41] which occurred between 70 and 40 MYA. They formed due to the collision of the Pacific Ocean oceanic crust[42] 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, given the low angle of subduction by which the oceanic crust passed under the less dense continental crust during the Laramide orogeny, this resulted in formation of the Rocky Mountains several hundred miles further inland than is normally observed. (USGS, 2014c)

As reported above, the Rocky Mountain System within Wyoming is composed of four physiographic provinces: Middle Rocky Mountains, Northern Rocky Mountains, Southern Rocky Mountains, and Wyoming Basin (USGS, 2003a). Each physiographic province is discussed in detail below.

<u>Middle Rocky Mountains</u> – Within Wyoming, the Middle Rocky Mountains includes much of the western and northwestern portions of the state. Folded sedimentary and volcanic mountains are characteristic of this province (NPS, 2014b). Wyoming's Bighorn Mountains constitute one of the most significant ranges within the Middle Rocky Mountains. “Rising from 5,000-6,000 feet above sea level in the foothills areas to more than 13,000 feet at the crest, the Bighorns form an imposing mountain barrier between the Powder River Basin on the east and the Bighorn Basin, on the west” (Keefer, 1974).

<u>Northern Rocky Mountains</u> – The Northern Rocky Mountains include a small portion of Park County in extreme northwestern Wyoming. “The mountains in the Northern Rocky [Mountains] Province are smaller than those found in the Middle and Southern Rockies.” (NPS, 2014b)

<u>Southern Rocky Mountains –</u> Within Wyoming, the Southern Rocky Mountains Province include ranges within the southeastern portion of the state. The province is noted for its mountain ranges, including the Laramie Mountains, which start at 5,000 feet above sea level (ASL) and reach elevations of 9,000 feet ASL at their peaks (Keefer, 1974). “[Characteristic] structures of the Southern Rockies include anticlinal[43] arches and intermontane[44] basins” (NPS, 2014b).

<u>Wyoming Basin</u> – The Wyoming Basin includes the area between the Middle Rocky Mountains and Southern Rocky Mountains, including much of the central and southwestern portions of the state. This province is characterized “an elevated depression with structural features dating back to the mountain building event that shaped the Rocky Mountains (the Laramide Orogeny). Characteristic features of the Wyoming Basin include hogbacks, cuestas, and numerous basins that are separated by mountains of varying size” (NPS, 2014b). Two of the largest basins within

[41] Orogeny: “An episode of mountain building and/or intense rock deformation.” (USGS, 2015e)
[42] Crust: “The rocky, relatively low density, outermost layer of the Earth.” (USGS, 2015e)
[43] Anticline: “A downward-curving (convex) fold in rock that resembles an arch. The central part, being the most exposed to erosion, display the oldest section of rock.” (USGS, 2015e)
[44] Intermontane [basins] are wide valleys between mountain ranges.

the Wyoming Basin include the Green River Basin and the Wind River Basin (Wyoming State Geological Survey, 2015a).

18.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[45] 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,[46] subsidence,[47] and erosion (Thompson, 2015).

Much of the geology of the Rocky Mountains within Wyoming is attributable to glaciations that occurred over the last 200,000 years. The Bull Lake Glaciation spanned the period between 200,000 and 130,000 years ago, while the Pinedale Glaciation occurred between 30,000 and 10,000 years ago. The Pinedale Glaciation was primarily composed of mountain glaciers rather than continental ice sheets. Both glaciations carved out large valleys in Wyoming's Rocky Mountains. (USFS, 2015a)

Nearly all rivers, streams, and large tributaries in Wyoming's Interior Plains have alluvial[48] terraces, ranging from 5 to 40 feet above present-day streams. These terraces represent former valley floors. The oldest within Wyoming's terrace deposits date from the Pleistocene Epoch (2.6 MYA to 11,700 years ago). The terrace deposits often contain calcium carbonate and gypsum. (Leopold & Miller, 1954)

Figure 18.1.3-2 depicts a generalized illustration of the surface geology for Wyoming.

[45] Till: "Unsorted, unstratified rock rubble or debris carried on and/or deposited by the ice of a glacier." (USGS, 2015e)
[46] 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)
[47] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000).
[48] Alluvium: "Sand, gravel, and silt deposited by rivers and streams in a valley bottom." (USGS, 2015e)

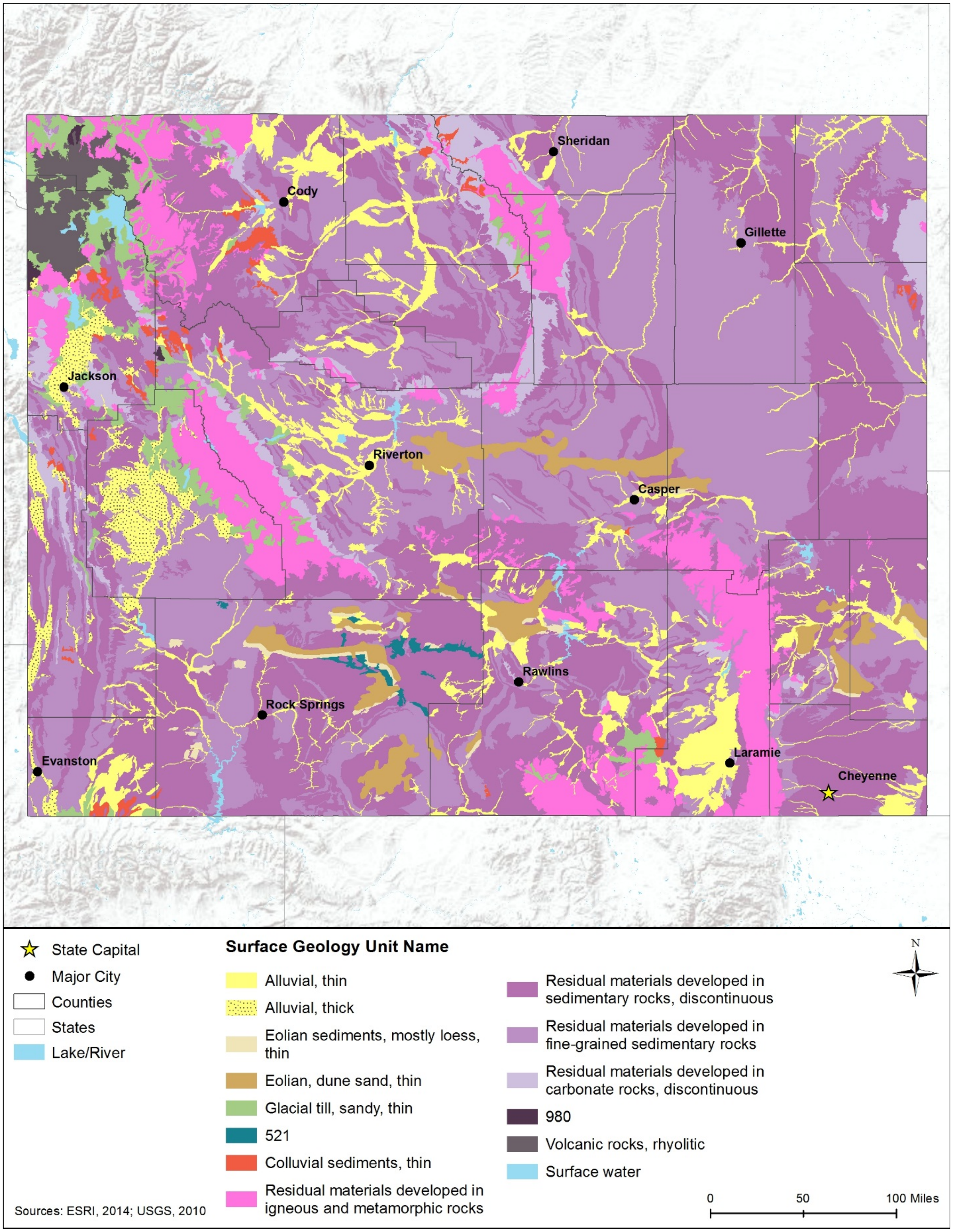


Figure 18.1.3-2: Generalized Surface Geology for Wyoming

18.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015b) reveals important information about a region's surface and subsurface characteristics (i.e., three dimensional geometry), including dip (slope of the formation),[49] rock composition, and regional tectonism.[50] 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).

Precambrian (older than 542 MYA) rocks in Wyoming are exposed in several locations. The Sherman Granite[51] is an intrusive[52] igneous[53] rock mass that is exposed along Interstate 80 in eastern Wyoming. Other uplifted rock bodies across the state also include Precambrian rocks. Marine sediments, including limestone,[54] dolomite,[55] sand, gravel, and mud are found in Cambrian (542 to 488 MYA) and Ordovician (488 to 444 MYA) rocks. During the Pennsylvanian Period (318 to 299 MYA) erosion of newly-formed mountains resulted in sediment deposits into nearby low-lying basins. In western Wyoming, Permian (299 to 251 MYA) sandstone,[56] shale,[57] red siltstone,[58] and gypsum sequences are exposed, as the state was underwater during this time. During the early Mesozoic Era (251 to 66 MYA), red sediments were deposited. As oceans advanced and receded, marine clays, sand, and mud were deposited. By the end of the Cretaceous Period (146 to 66 MYA) and early Cenozoic Era (66 MYA to present), the Sevier and Laramide orogenies had shaped the modern geology of Wyoming. The Sevier orogeny produced the Thrust Belt in western Wyoming, including the Snake River, Sublette, Wyoming, Salt River, Tunp, and Hoback mountain ranges. The Laramide orogeny displaced sedimentary rocks along with crystalline basement rock. Volcanic activity was common during this time, resulting in the deposition of ash and volcanoclastic rocks in the state (Wyoming State Geological Survey, 2015a) (University of California Museum of Paleontology, 2011).[59] Figure 18.1.3-3 displays the general bedrock geology for Wyoming.

[49] 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).
[50] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust." (USGS, 2016a)
[51] Granite: "A coarse-grained intrusive igneous rock with at least 65 percent silica. Quartz, plagioclase feldspar and potassium feldspar make up most of the rock and give it a fairly light color." (USGS, 2015e)
[52] Intrusive Rock: "Igneous rock that cools and solidifies beneath the Earth's surface." (USGS, 2015e)
[53] Igneous Rock: "Rock formed when molten rock (magma) that has cooled and solidified (crystallized)." (USGS, 2015e)
[54] 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, 2015e)
[55] Dolomite: "A magnesium-rich carbonate sedimentary rock. Also, a magnesium-rich carbonate mineral ($CaMgCO_3$)." (USGS, 2015e)
[56] Sandstone: "Sedimentary rock made mostly of sand-sized grains." (USGS, 2015e)
[57] 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, 2015e)
[58] Siltstone: "A sedimentary rock made mostly of silt-sized grains." (USGS, 2015e)
[59] The geologic time scale used by researchers and scientists varies (slightly) by each state geological survey. This PEIS uses the geologic time scale references of the University of California Museum of Paleontology for all states: http://www.ucmp.berkeley.edu/help/timeform.php.

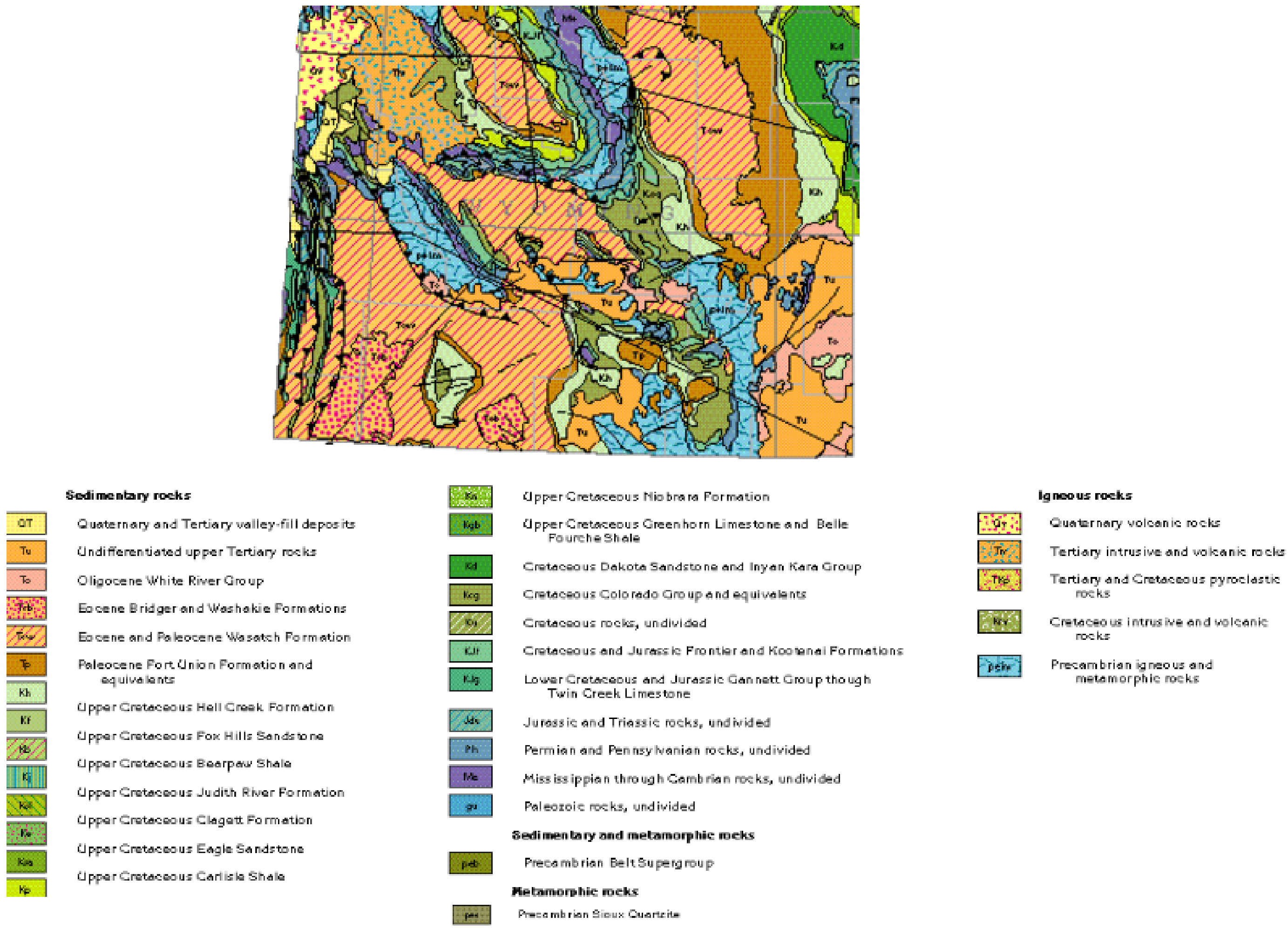


Figure 18.1.3-3: Generalized Bedrock Geology for Wyoming

Source: (USGS, 1996a)

Paleontological Resources

Marine fossils dating from the Cambrian (542 to 488 MYA) and early Carboniferous Period (359 to 299 MYA) are commonly found in Wyoming. Marine fossils from the Cambrian Period include trilobites,[60] brachiopods,[61] algae, corals, and crionoids, while from the Permian age, brachiopods, sponges, horn corals, bryozoans,[62] pelecypods, gastropods,[63] belemnites, ostracods, conodonts,[64] and fish. By the late Carboniferous Period, the sea had retreated from the state; Wyoming remained dry through the Triassic Period (251 to 200 MYA). Shallow marine deposits have been found from the Jurassic Period (200 to 146 MYA), with marine fossils and dinosaur tracks recorded in tidal deposits; along riverine floodplains, the Morrison Formation contains extensive dinosaur fossils and marine fossils. Fossils from the Triassic and Jurassic Periods can be found, including oysters, belemnites, and dinosaur fossils such as Apatosaurus, Stegosaurus, Allosaurus, Diplodocus, Camarasaurus, and others. Both marine and terrestrial fossils have been found from the Cretaceous Period (146 to 66 MYA), as the Western Interior Seaway retreated and advanced. Cretaceous fossils in Wyoming include fish, frogs, salamanders, turtles, crocodiles, pterosaurs, mammals, birds, and dinosaurs, such as the Ankylosaurus Troodon, Edmontosaurus, Tyrannosaurus, Triceratops, Pachycephalosaurus, Edmontonia, Dromaeosaurus, and Ornithomimus. Cenozoic Era (66 MYA to present) fossils collections are very diverse in Wyoming. Fossil plants, fish, flamingos, crocodiles, boas, and bats fossils have been found from the Tertiary Period (66 to 2.6 MYA). Fossil diatoms, pollen, mammoth, horse, camel, bison, and Pronghorn antelope fossils have been found from the Quaternary Period (2.6 MYA to present). (The Paleontology Portal, 2015a)

Wyoming State Fossil
Knightia Eocaena

Source: (NPS, 2016f)

The state fossil of Wyoming is the Knightia. Found in abundance in the Green River Formation, it is an extinct genus of fish that were typically 25 cm or smaller (State of Wyoming, 2015c).

[60] 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)

[61] 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)

[62] Bryozoan: "Common name for any member of the phylum Bryozoa. Bryozoans are invertebrate aquatic organisms most commonly found in large colonies." (Smithsonian Institution, 2016)

[63] Gastropods: "Any member of a large class of mollusks (Gastropoda), commonly called snails. Gastropods live in marine, freshwater, and terrestrial habitats. They have a univalve, often spiral shell (or none at all), a muscular foot for locomotion, and distinctive sensory organs." (Smithsonian Institution, 2016)

[64] 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)

18.1.3.6. Fossil Fuel and Mineral Resources

Oil and Gas

In 2015, Wyoming produced more than 87 million barrels of oil. Wyoming typically accounts for 2 to 3 percent of nationwide crude oil production (EIA, 2014). Much of Wyoming's crude oil production operations take place in Campbell, Converse, and Laramie counties (Wyoming State Geological Survey, 2015b). Drilling has recently extended into eastern Wyoming within the Niobrara Shale and Powder River Basin. In addition, the Green River shale in southwestern Wyoming potentially contains significant oil resources (EIA, 2014).

In 2014, Wyoming produced 1,791,235 million cubic feet of natural gas, which accounted for 6.6 percent of total nationwide production (EIA, 2014); this level of production ranked fifth among states nationwide (EIA, 2016a). Natural gas is typically produced in the southwestern portion of Wyoming within the Greater Green River Basin (EIA, 2014). Natural gas reserves may also be present under the Laramide basins (Wyoming State Geological Survey, 2015b).

Minerals

As of 2015, Wyoming's nonfuel mineral production value was $2.37B, ranking 13th nationwide (in terms of dollar value). This accounts for 3.03 percent of the total nationwide nonfuel mineral production. Wyoming's leading nonfuel mineral commodity was soda ash. Wyoming is also a producer of bentonite clay, Grade-A helium, sand and gravel (construction), and cement (Portland) (USGS, 2016b).

Wyoming is the nation's leading coal producer, producing 395,665 thousand short tons in 2014 (EIA, 2016b). This accounted for 39.6 percent of total nationwide coal production. Large sub-bituminous[65] coal seams are shallow and can be extracted from surface mines. The state's largest coal mines are in the Powder River Basin in the northeastern corner of the state (EIA, 2014).

18.1.3.7. Geologic Hazards

The four major geologic hazards of concern in Wyoming are volcanoes, earthquakes, landslides, and subsidence. The subsections below summarize current geologic hazards in Wyoming.

Volcanoes

In Wyoming, volcanic activity is limited to the Yellowstone area in the northwestern corner of the state. Three significant eruptions in have occurred in Yellowstone within the last 2.1 million years, along with other smaller events. During each volcanic eruption, “enormous volumes of magma[66] erupted at the surface and into the atmosphere as mixtures of red-hot pumice,[67] volcanic ash[68] (small, jagged fragments of volcanic glass and rock), and gas spread as pyroclastic (“fire-

[65] Sub-bituminous coal: “A rank class of nonagglomerating coals having a heat value content of more than 8,300 Btu's and less than 11,500 Btu's on a moist, mineral-matter-free basis.” (USGS, 1981)
[66] Magma: “Molten rock. Magma may be completely liquid or a mixture of liquid rock, dissolved gases and crystals. Molten rock that flows out onto the Earth's surface is called lava.” (USGS, 2015e)
[67] Pumice: “A light-colored, frothy, glassy volcanic rock.” (USGS, 2015e)
[68] Ash: “Fine particles of volcanic rock and glass blown into the atmosphere by a volcanic eruption.” (USGS, 2015e)

broken") flows[69] in all directions." One of the eruptions, which occurred just south of Mammoth Hot Springs, produced a volcanic caldera[70] that measured more than 60 miles in diameter. Though it is likely that a future pyroclastic eruption will occur at Yellowstone, it is far more likely that events in the immediate future will take the form of a lava[71] flow. "Since Yellowstone's last caldera forming eruption 640,000 years ago, about 30 eruptions of rhyolitic[72] lava flows have nearly filled the Yellowstone Caldera" (USGS, 2005a). Figure 18.1.3-4 displays the location of the Yellowstone Caldera.

[69] 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, 2015e)
[70] Caldera: "Large, generally circular, fault-bounded depression caused by the withdrawal of magma from below a volcano or volcanoes." (USGS, 2015e)
[71] Lava: "Magma that reaches the Earth's surface through a volcanic eruption. When cooled and solidified, forms extrusive (volcanic) igneous rock. (USGS, 2015e)
[72] Rhyolite: "A volcanic rock chemically equivalent to granite. Usually light colored, very fine-grained or glassy-looking. May have tiny visible crystals of quartz and/or feldspar dispersed in a glassy white, green, or pink groundmass." (USGS, 2015e)

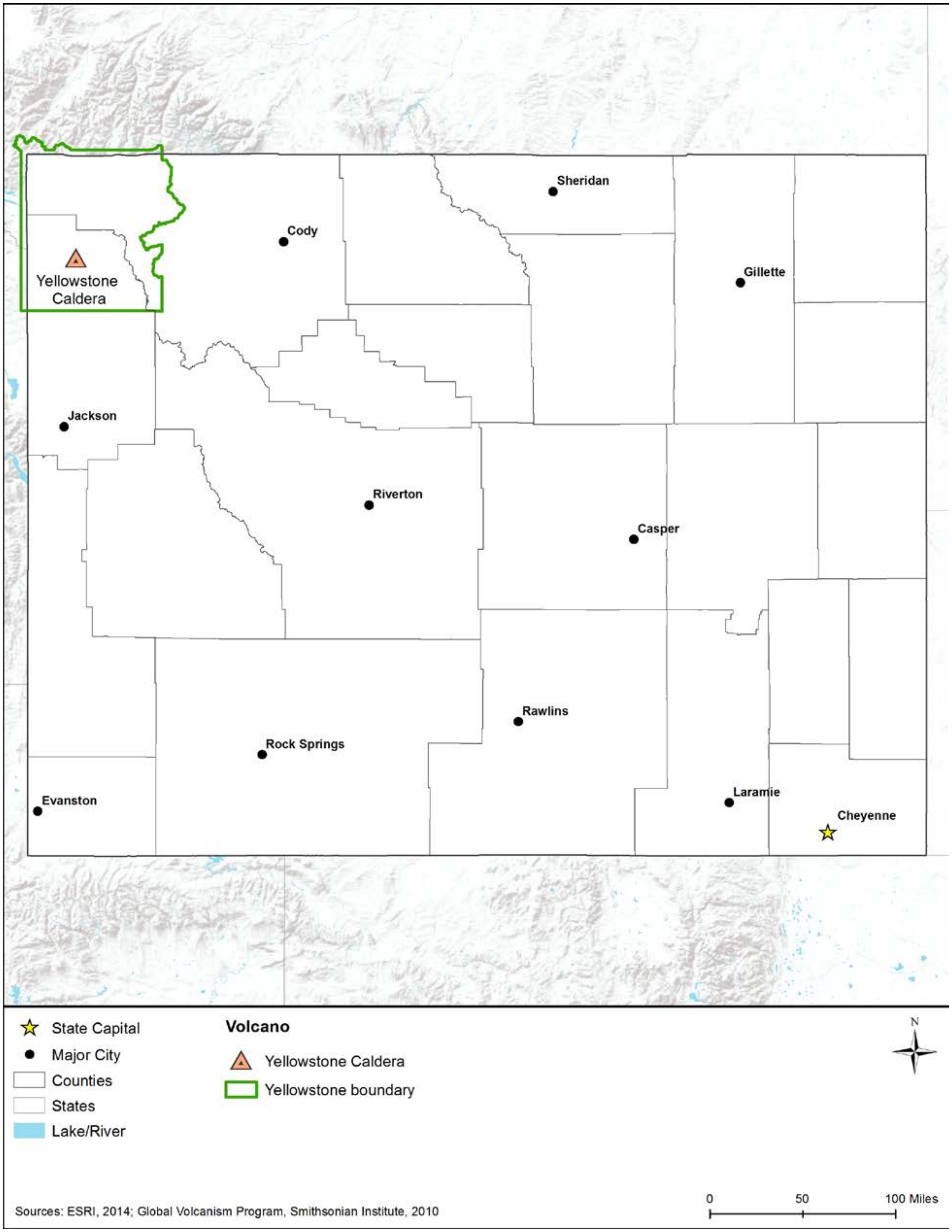


Figure 18.1.3-4: Location of the Yellowstone Caldera

Earthquakes

Between 1973 and March 2012, there were approximately 40 earthquakes of a magnitude 4.5 (on the Richter scale[73]) or greater in (or in immediate proximity to) Wyoming (USGS, 2014b). Earthquakes are the result of large masses of rock moving against each other along fractures called faults. Earthquakes occur when landmasses on opposite sides of a fault suddenly slip past each other; the grinding motion of each landmass sends out shock waves. The vibrations travel through the earth and, if they are strong enough, they can damage manmade structures on the surface (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 in Wyoming, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale. Wyoming is located far from any convergence boundaries.

Figure 18.1.3-5 depicts the seismic risk throughout Wyoming; 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 (percent g). Most pre-1965 buildings are likely to experience damage with exceedances of 10 percent g. Post-1985 buildings (in California) have experienced only minor damage with shaking of 60 percent g. (USGS, 2010)

Areas of greatest seismicity in Wyoming are concentrated in the northwest portions of the state. In particular, locations within Yellowstone National Park are at the greatest risk of experiencing a significant earthquake event (Wyoming State Geological Survey, 2015c). On average, between 1,000 and 3,000 earthquakes occur within Yellowstone National Park each year, though most are imperceptible to humans. Magnitude 3 to 4 earthquakes are commonly felt in the Park several times a year (USGS, 2005a). “The largest earthquake recorded to date in Wyoming occurred on August 18th, 1959 in Yellowstone National Park. The earthquake registered as a magnitude 6.5 and is considered to be an aftershock of the magnitude 7.5 Hebgen Lake earthquake in southwestern Montana” (Wyoming State Geological Survey, 2015c).

[73] The Richter scale is a numerical scale for expressing the magnitude of an earthquake on the basis of seismograph oscillations. The more destructive earthquakes typically have magnitudes between about 5.5 and 8.9; the scale is logarithmic and a difference of one represents an approximate thirtyfold difference in magnitude. (USGS, 2014d)

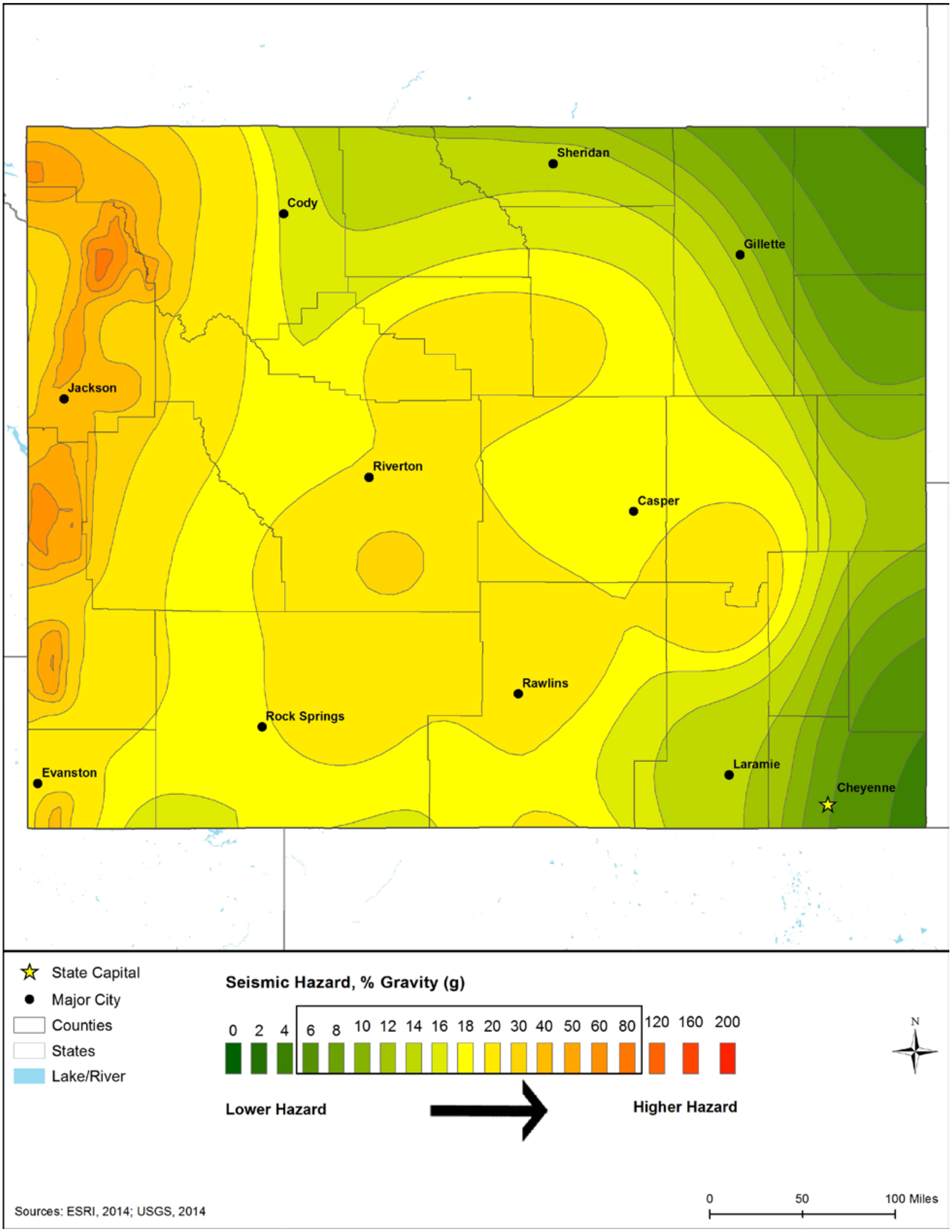


Figure 18.1.3-5: Wyoming 2014 Seismic Hazard Map

Landslides

Portions of Wyoming are at risk to landslides, particularly in the western portions of the state within the Southern, Middle, and Northern Rocky Mountain Provinces, as well as in the northeastern portion of the state in areas near the Black Hills (USGS, 1982).

“The term 'landslide' describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides and other ground failures” (USGS, 2003b). Geologists use the term “mass movement” to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale (USGS, 2003b).

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

As noted above, portions of Wyoming are highly susceptible to, or demonstrate high incidence of, landslides. While some areas are landslide-prone due to weak underlying geology (including interbedded sandstone, mudstone, shale, and limestone), other areas are susceptible to landslides due to “[mobilization] by melt water and torrential rains” at higher elevations (USGS, 1982). Figure 18.1.3-6 “shows landslide incidence and susceptibility throughout Wyoming.

Wyoming Gros Ventre Landslide (1925)

In June 1925, one of the fastest moving and largest recorded landslides in Wyoming occurred on the north slope of Sheep Mountain near the town of Kelly. More than 50 million cubic yards of earth moved 300 feet within 3 minutes, resulting in the blockage of the Gros Ventre River and formation of Slide Lake (which later failed in 1927). It is believed that the landslide may have been caused by the saturation of soils by heavy rains and snowmelt, or erosion of sandstone bedrock which was undercut by the Gros Ventre River. (USFS, 2016d)

Source: (NPS, 2007)

Subsidence

Land subsidence is a “gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials.” Land subsidence has been observed throughout Wyoming, as discussed in further detail below. Nationwide, the main triggers of land subsidence can be aquifer compaction, drainage of organic soils, mining, sinkholes, and thawing permafrost.

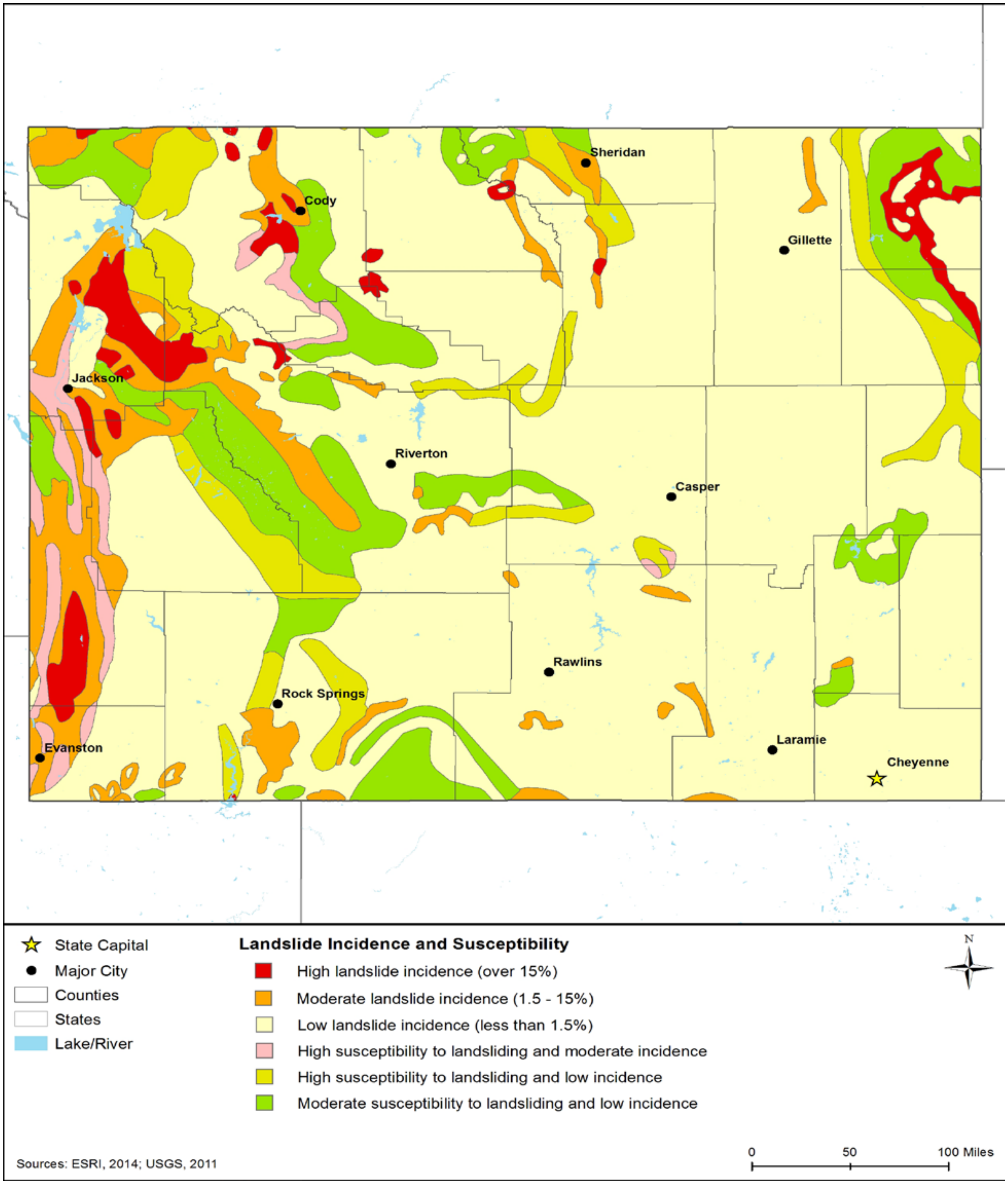


Figure 18.1.3-6: Wyoming Landslide Incidence and Susceptibility Hazard Map[74]

[74] Susceptibility hazards not indicated in Figure 18.1.3-6 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, 2014h)

More than 80 percent of subsidence in the United States is due to over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If an aquifer is confined by layers of silt or clay, which do not transport groundwater, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the permanent lowering of the land surface elevation (USGS, 2000).

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

In Wyoming, mine subsidence stemming from coal mines has been a problem in Wyoming since the 1860s. "Significant subsidence problems have occurred in Rock Springs, Hanna, Glenrock, Superior, Reliance, Evanston, Kemmerer, Sheridan, and Gillette" (WOHS, 2011). Landscapes are particularly susceptible to mine subsidence when coal is removed and the overlying terrain can no longer be supported. This is common in areas where the ground thickness above the mine is less than 200 feet. North of Sheridan, multiple collapsed areas have been observed where the terrain overlying the mine is only 30 to 50 feet thick. Mine subsidence may also lead to "spontaneous ignition when water and air enter the abandoned mine workings via subsidence cracks and pits" (Dunrud & Osterwald, 1980).

Portions of Wyoming also are susceptible to land subsidence due to karst[75] topography. Within karst landscapes, as bedrock dissolves, the land surface may subside if subterranean areas no longer provide sufficient support. Within Wyoming, karst topography commonly develops in areas that are underlain by carbonate rocks, and rocks containing the mineral gypsum,[76] which dissolves as water infiltrates the land surface. While gypsum is present throughout Wyoming, it is especially pervasive in Crook County in the northeastern corner of the state. Natural sinkholes, which formed due to bedrock dissolution as recently as spring 2012, have been documented within Crook County (Crook County, 2013). Figure 18.1.3-7 displays the areas throughout the state that are susceptible to karst topography formation.

[75] Karst Topography: "A distinctive landscape (topography) that can develop where the underlying bedrock, often limestone or marble, is partially dissolved by surface or groundwater." (USGS, 2015e)
[76] Gypsum: "The mineral form of hydrated calcium sulfate, $CaSO_4 \cdot 2H_2O$." (USGS, 2005b)

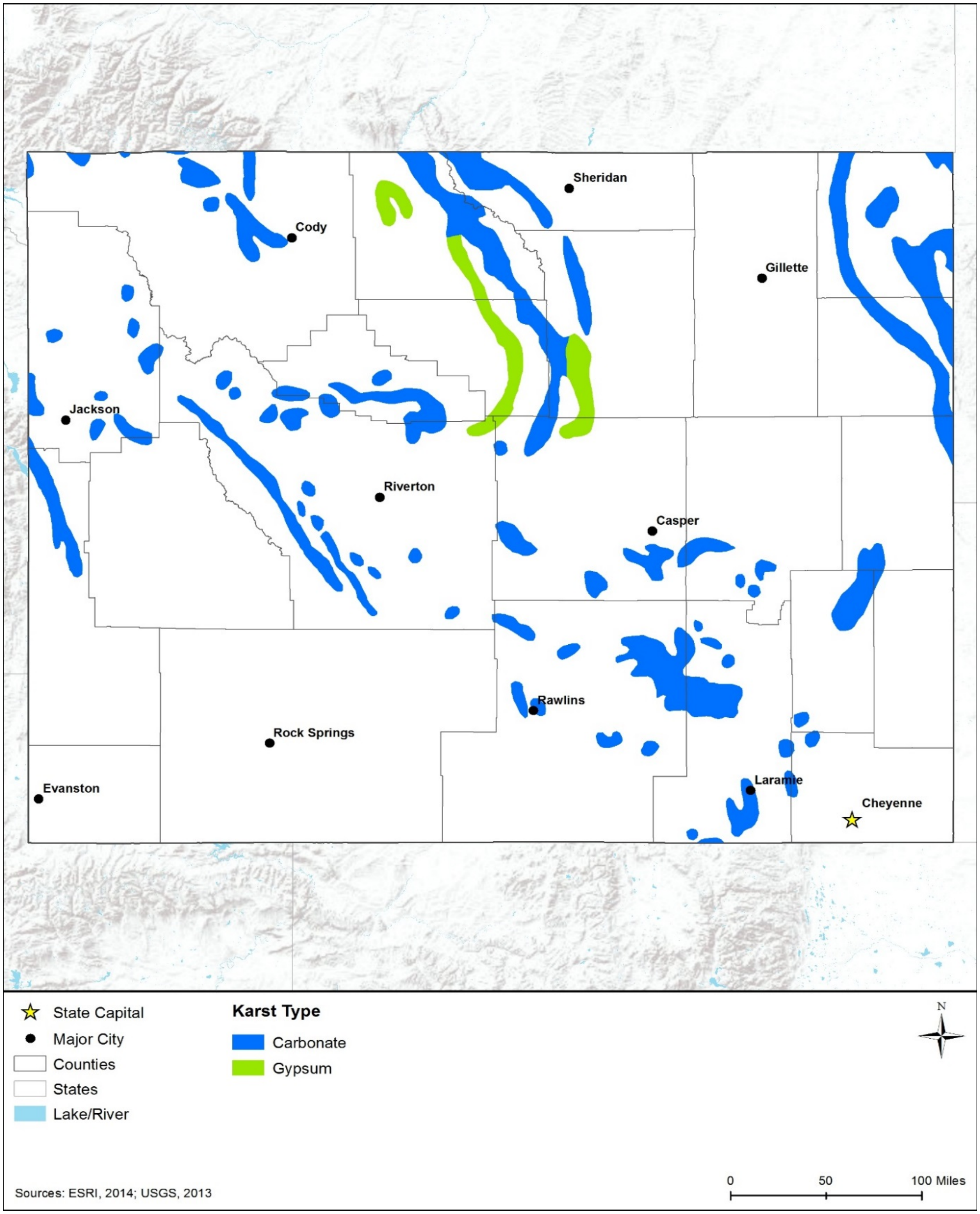


Figure 18.1.3-7: Karst Topography in Wyoming

18.1.4. Water Resources

18.1.4.1. Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 18.1.5). 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 services. (USGS, 2014f)

18.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C, Environmental Laws and Regulations. Table 18.1.4-1 identifies the relevant laws and regulations for water resources in Wyoming.

Table 18.1.4-1: Relevant Wyoming Water Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
General Wyoming Water Laws and Regulations	Wyoming State Engineer’s Office and Board of Control	Defines Wyoming water permit requirements.
WPDES Program	WDEQ – Surface Water Division	Small Construction General Permit: For construction activities that disturb one or more acre of surface soil (WDEQ, 2015h).
Clean Water Act (CWA) Section 404 permit, Nationwide Permit (NWP) Wyoming regional conditions	U.S. Army Corps of Engineers (USACE), Omaha District	Wyoming Resources Office must be notified prior to dredge and fill activities authorized under NWPs in the following waterbodies: parts on the Snake, Green, Wind, North Platte, Middle Fork, Powder, Tongue, Sweetwater, Encampment, and Clarks Fork Rivers; Sand, Fish, and Granite Creeks; and Fremont Lake (USACE, 2012).
CWA Section 401 permit	WDEQ – Water Quality Division	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from WDEQ indicating that the proposed activity will not violate water quality standards (WDEQ, 2015i).

18.1.4.3. Surface Water

Surface water resources are lakes, ponds, rivers, and streams. According to the Wyoming Water Development Commission (WWDC), the state’s total surface water area is 456,000 acres. “Wyoming straddles the Continental Divide and provides the headwaters of four major river basins of the West: the Missouri, the Colorado, the Great Basin, and the Columbia.” (WWDC,

2007) Wyoming includes “approximately 280,804 miles of streams and 569,269 acres of lakes, reservoirs, ponds, and wetlands” (WDEQ, 2012a).

Watersheds

Wyoming’s waters (lakes, rivers, and streams) are divided into 7 major watersheds, or drainage basins (Figure 18.1.4-1). Visit http://waterplan.state.wy.us/ for information and additional maps about each Wyoming Water Development Commission watershed’s location, size, and water quality (WWDC, 2015).

The Platte River Watershed is one of the largest watersheds in the state, making up nearly 25 percent of the land area (WWDC, 2006). The Bear River in the Bear River Watershed, which spans across Utah, Idaho, and Wyoming, is the “largest tributary to the Great Salt Lake,” with headwaters originating from the Uinta Mountains (WWDC, 2012). The rivers and streams in the Green River Watershed “drain to the largest tributary of the Colorado River” (WWDC, 2010a). The Northeast River Watershed includes drainages of Little Missouri River, Belle Fourche River, Cheyenne River, and Upper Niobrara River (WWDC, 2002a). The Little Bighorn, Tongue, and Powder Rivers in the Powder/Tongue River Watershed, situated in between Northeast and Wind/Bighorn River Watersheds, flow east from the Bighorn Mountains and north into Montana’s Yellowstone River (WWDC, 2002b). The Snake/Salt River Watershed includes the Grand Teton National Park and portions of Yellowstone National Park (WWDC, 2014). The Wind/Bighorn River Basin in the northwest part of Wyoming encompasses approximately 23 percent of the state’s land area (WWDC, 2010b).

Freshwater

As shown in Figure 18.1.4-1, there are 15 major rivers in Wyoming: Snake, Clarks Fork/Yellowstone, Bighorn, Greybull, Nowood, North Fork, South Fork, Powder, Belle Fourche River, Little Missouri, North Platte, Sweetwater, Wind, New Fork, and Bear Rivers. Three of the nation’s major river systems have their headwaters in Wyoming: the Missouri, Colorado, and Columbia rivers. The Snake River, at more than 1,000 miles, is the longest river in the state, followed by the Green River at 730 miles. “About 72 percent of Wyoming’s land area drains northward and eastward into the Missouri River system. Tributaries of the Colorado River drain about 17 percent of Wyoming. The Bear River meanders along the western border of Wyoming and ends in Great Salt Lake in the Great Basin. The Snake River starts in Wyoming and is tributary to the Columbia River. The Bear and Snake Rivers drain about 7 percent of the state’s land area. The remaining 4 percent is in the closed Great Divide Basin” (WWDC, 2007).

There are nine major lakes and reservoirs: Shoshone, Fremont, Yellowstone, Jackson, Ocean Lakes, Pathfinder, Seminoe, Flaming Gorge, and Boysen Reservoir. Fremont Lake in Pinedale, is part of the Bridger-Teton National Forest and is the state’s second largest natural lake. Formed by glaciers, it is 12 miles long, 0.5 miles wide, and the seventh deepest lake in the country at 696 feet. (USGS, 1989)

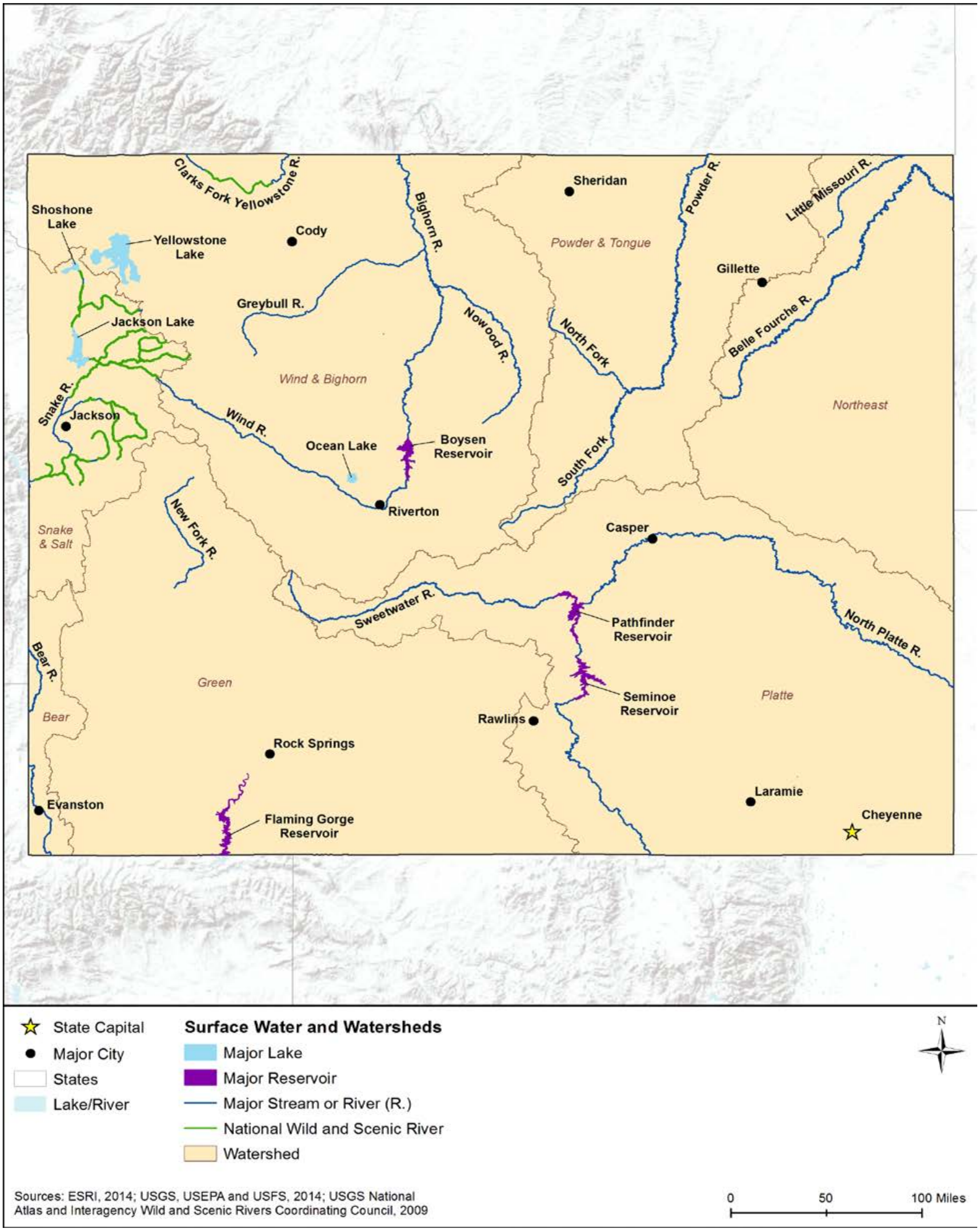


Figure 18.1.4-1: Major Wyoming Watersheds and Surface Waterbodies

18.1.4.4. Sensitive or Protected Waterbodies

Wild and Scenic Rivers

Wyoming has two federally designated wild and scenic rivers, the Snake River Headwaters and the Clarks Fork (Yellowstone River). The Snake River Headwaters was designated as part of the Snake River Headwaters Legacy Act of 2009 (Public Law [PL] 111-11) (Figure 18.1.4-2). It encompasses all or segments of 13 rivers and streams in the Snake River Headwaters, totalling approximately 400 miles, with 315 miles within the Bridger-Teton National Forest. "The Snake River Headwaters is unique in that it encompasses a connected watershed, rather than just one river or isolated rivers across a region" (USFS, 2014a). The Headwaters were recognized because of their economic (trout and other fishing), scenic, cultural significance, and recreational value. (USFS, 2014a)

The 20.5-mile segment of the Clarks Fork of the Yellowstone River is approximately 30 miles from Cody, Wyoming, on the Shoshone National Forest (USFS, 2009a). Classified as a wild river, the Clarks Fork River is "free of impoundments" and is generally "inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted" (USFS, 2009b). Additionally, the river is important habitat to many species, including "grizzly bears, gray wolves, moose, elk, deer, and other smaller species" (National and Wild Scenic Rivers 2015).

Figure 18.1.4-2: Wild and Scenic Snake River Headwaters, Granite Creek

Source: (USFS, 2015b)

18.1.4.5. 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 (World Health Organization, 1996). Under Section 303(d) of the CWA, states are required to assess water quality and report a listing of impaired waters,[77] the causes of impairment, and probable sources. Table 18.1.4-2 summarizes the water quality of Wyoming's assessed major waterbodies by category, percent impaired, designated use,[78] cause, and probable sources. Figure 18.1.4-3 shows the Section 303(d) waters in Wyoming as of 2012.

As shown in Table 18.1.4-2, various sources affect Wyoming's waterbodies, causing impairments. Of the waters assessed in Wyoming, including 16 percent of rivers and streams and 6 percent of lakes, reservoirs, and ponds, most are in good condition. Almost all of the state's rivers and streams and lakes, reservoirs, and ponds meet their designated uses (support aquatic life other than fish, coldwater fishery, and agriculture). The top causes of impairment include pathogens, metals, and sediment. (USEPA, 2015c)

Table 18.1.4-2: Section 303(d) Impaired Waters of Wyoming, 2012

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	16%	8%	Aquatic life other than fish, coldwater fishery, agriculture	Pathogens[c], metals such as selenium and arsenic, and sediment	Unknown, natural/wildlife, agricultural, and industrial
Lakes, Reservoirs, and Ponds	6%	33%		Sediment, metals such as selenium, and nutrients such as phosphates	Unknown, agricultural and natural/wildlife

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

Source: (USEPA, 2015c)

WDEQ has identified E. coli, metals such as selenium and arsenic, sediment, and habitat modification as the most significant nonpoint source causes of impaired streams. Sediment from irrigated agriculture was the single largest nonpoint source cause of impaired lakes and reservoirs (WDEQ, 2012b). For more information on Wyoming's water quality, visit WDEQ (Water Quality – Water & Wastewater) at http://deq.wyoming.gov/wqd/water-wastewater/ (WDEQ, 2016).

[77] 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, 2015d)
[78] 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, 2015d)

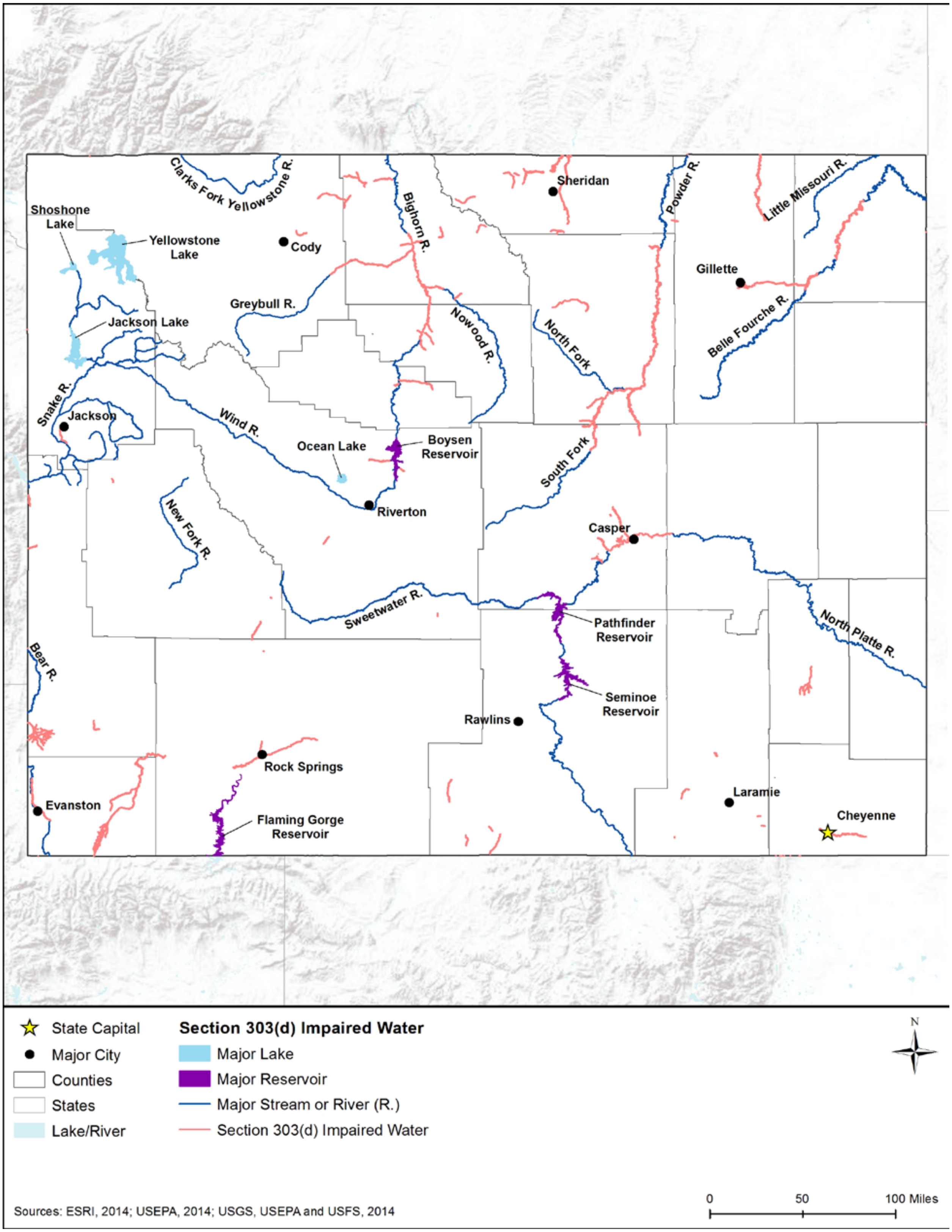


Figure 18.1.4-3: Section 303(d) Impaired Waters of Wyoming, 2014

18.1.4.6. 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). 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).

Riverine and lake floodplains are the primary type of floodplains in Wyoming. They 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)

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, 2015a). There are several causes of flooding in Wyoming, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. These include severe rain events, rapid snowmelt, ice jams, and dam failure (WRDS, 2004).

Although some areas, such as floodplains, are more prone to flooding than others, no area in the state is exempt from flood hazards. There were several large flood events in Wyoming's history, including an event that resulted in 18 fatalities in 1923. In August 1985, the most damaging flood in the state's history occurred in Cheyenne. The flood resulted in 12 fatalities, 70 injuries, and more than $65 million in crop and property damage. (WRDS, 2004)

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. FEMA provides floodplain management assistance, including mapping of 100-year floodplain limits, to approximately 85 communities in Wyoming through the National Flood Insurance Program (NFIP) (FEMA, 2014c). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities “to adopt and enforce floodplain management regulations and to implement broader floodplain management programs” and allows property owners in participating communities additional protection against losses from flooding (FEMA, 2015a). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, Wyoming had six communities participating in the CRS (FEMA, 2014d).[79]

18.1.4.7. 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, other surface bodies of water, or wetlands. This exchange between surface water and groundwater is an important feature of the hydrologic (water) cycle (USGS, 2013b).

Wyoming’s principal aquifer types are are the High Plains and equivalent, the structural basin, the carbonate-rock[80] and sandstone,[81] and the alluvial.[82] More than 100 different aquifers are used for water supplies and water wells in Wyoming can range between 200 and 6,000 feet deep. Approximately 80 percent of Wyoming residents use groundwater for their drinking water. Statewide, the most serious threats to groundwater quality include human activities (oil and gas development, increased density of onsite septic systems), changing land use, and climate change. (WDEQ, 2012a)

Table 18.1.4-3 provides details on aquifer characteristics in the state; Figure 18.1.4-4 shows Wyoming’s principal and sole source aquifers. The Northern Rocky Mountains Intermontane Basins aquifer system occurs in a small part of western Wyoming. The aquifer is mostly found in Idaho, and is thus discussed in detail in Idaho’s groundwater section (Section 5.1.4) (WDEQ, 2012a).

[79] A list of the 5 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (FEMA, 2014d) and additional program information is available from FEMA’s NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

[80] Carbonate-rock aquifers typically consist of limestone with highly variable water-yielding properties (some yield almost no water and others are highly productive aquifers) (Olcott, 1995a).

[81] 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).

[82] Alluvial aquifers “contain deposits of clay, silt, sand, gravel, or other particulate material that has been deposited by a stream or other body of running water in a streambed, on a flood plain, on a delta, or at the base of a mountain” (USGS, 2015d).

Table 18.1.4-3: Description of Wyoming's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Upper Tertiary Aquifer These aquifers consist mostly of broad, extensive sheets of alluvium that were deposited by a network of branching and rejoining streams.	Southern Wyoming	Upper Tertiary aquifers are important sources of water in southeastern Wyoming; they also supply water locally in central and western Wyoming.
Lower Cretaceous Consolidated sandstone with variable porosity and permeability	Southeastern corner	Commonly contain highly mineralized water where they are deeply buried.
Lower Tertiary Semi-consolidated and consolidated sandstone	Eastern two-thirds of state	Aquifer contains freshwater, and accounts for most groundwater withdrawals. The fine-grained rocks mostly form confining units but can yield small volumes of water where they are fractured or deeply weathered.
Upper Cretaceous Consolidated sandstone with variable/low permeability	In bands throughout state	Water is fresh only at shallow depths, and saline at depth. Water has high concentrations of dissolved minerals. These aquifers are widespread in the subsurface but contain freshwater only where they crop out and for a short distance where they are covered by younger rocks.
Paleozoic Consist of sandstone, dolomite, and limestone; the limestone formations	Occur in small, irregular, discontinuous areas. These aquifers generally crop out on the flanks of uplifts or where they have been folded upward into anticlines and were subsequently exposed by erosion.	At depth, the water can have high concentrations of dissolved minerals and contain oil, gas, and brine. Paleozoic aquifers are the most productive aquifers, in terms of providing drinking or well water.

Source: (Moody, Carr, Chase, & Paulson, 1986) (USGS, 1996b) (USGS, 2003c) (USGS, 2015c), (WDEQ, 2012b)

Sole Source Aquifers

The U.S. Environmental Protection Agency (USEPA) defines sole source aquifers (SSA) 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, 2015e). Wyoming has two designated SSAs within the state, the Eastern Snake River Plain SSA in the northeastern corner, and Elk Mountain SSA in the southwestern corner of the state (Figure 18.1.4-4). 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, 2015e).

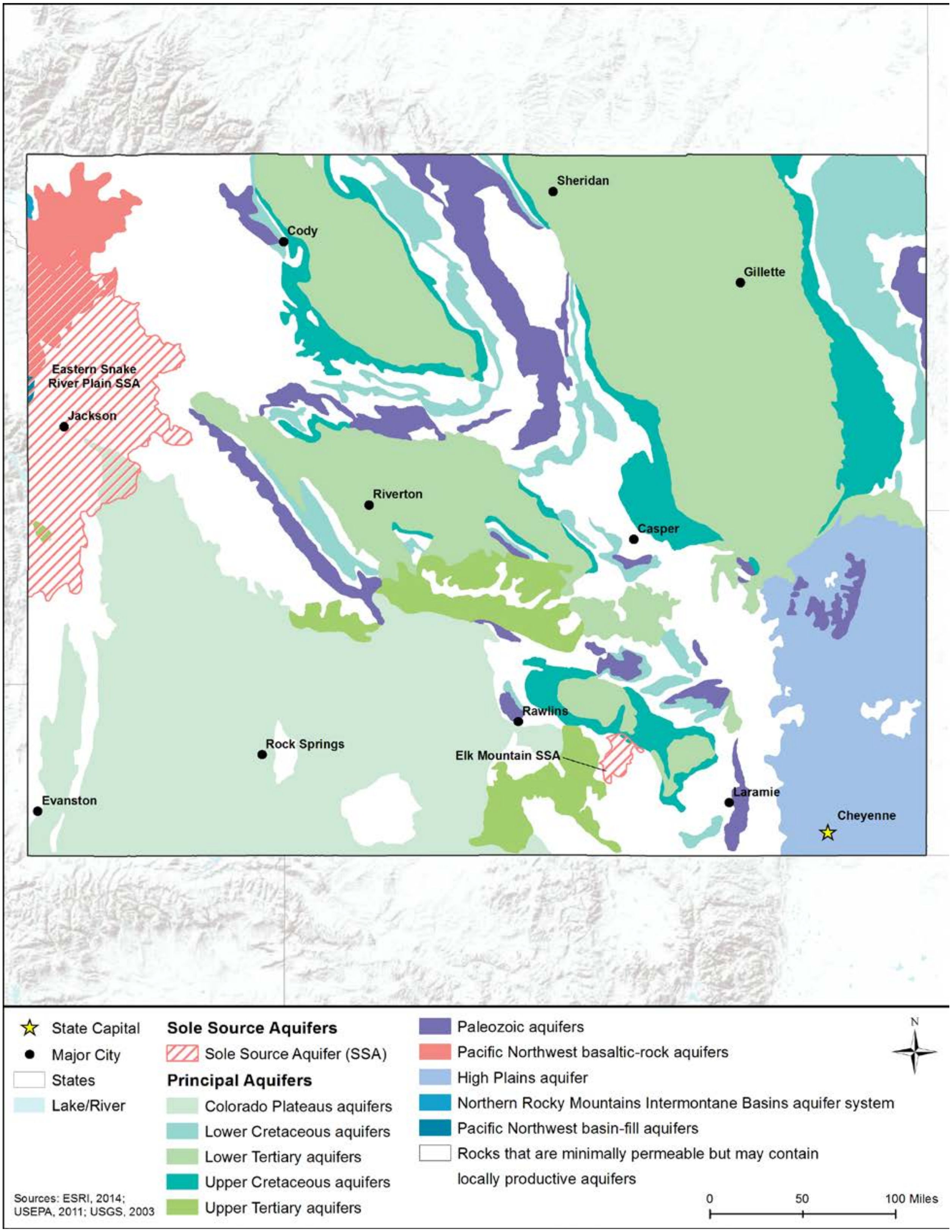


Figure 18.1.4-4: Principal and Sole Source Aquifers of Wyoming

18.1.5. Wetlands

18.1.5.1. 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)

18.1.5.2. Environmental Laws and Regulations

Appendix C, Environmental Laws and Regulations, explains the pertinent federal laws protecting wetlands in detail. Table 18.1.5-1 summarizes the major Wyoming state laws and permitting requirements relevant to the state's wetlands.

Table 18.1.5-1: Relevant Wyoming Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CWA Section 404 permit, NWP Wyoming regional conditions	USACE, Omaha District	The Wyoming Resource Office must be notified prior to dredge and fill activities authorized under NWPs in wetlands adjacent to the following waterbodies: parts on the Snake, Green, Wind, North Platte, Middle Fork, Powder, Tongue, Sweetwater, Encampment, and Clarks Fork Rivers; Sand, Fish, and Granite Creeks; and Fremont Lake. The Wyoming Regulatory Office must be notified before dredge and fill activities in wetlands classified as peatlands[83]. (USACE, 2012)
Wyoming Wetlands Act	WDEQ	Activities that convert wetlands may be required to purchase wetland mitigation banking credits in order to mitigate the loss of wetlands (WDEQ, 1995).
CWA Section 401 permit	WDEQ	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from WDEQ indicating that the proposed activity will not violate water quality standards (WDEQ, 2015i).
WPDES Program	WDEQ	Construction activities that disturb one or more acre of surface soil (WDEQ, 2015h).

[83] "Peat is "a soft organic material consisting of partly decayed plant and, in some cases, deposited mineral matter." Peatlands are areas of land composed of peat. (USGS, 2016d)

18.1.5.3. 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 (Cowardin, Carter, Golet, & LaRoe, 1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. Three of these Systems, Riverine, Lacustrine, and Palustrine, are present in Wyoming, as detailed in Table 18.1.5-2.[84]

In Wyoming, the main type of wetlands are palustrine (freshwater) wetlands found on river and lake floodplains across the state. Riverine and lacustrine wetlands are also found throughout the state.

- The Marine System consists of open ocean, continental shelf, including beaches, rocky shores, lagoons, and shallow coral reefs. Normal marine salinity (saltiness) to hypersaline (more than 30 percent salty) water chemistry; minimal influence from rivers or estuaries. Where wave energy is low, mangroves, or mudflats may be present.
- "The Estuarine System consists of deepwater tidal habitats and adjacent tidal habitats that 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."
- "The Riverine System includes all wetlands and deepwater habitats contained within a channel with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergent, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 ppt."
- The 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. The System includes lakes, larger ponds, sloughs, lochs, bayous, etc.
- "Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent." The System is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types). (Cowardin, Carter, Golet, & LaRoe, 1979) (FGDC, 2013)

[84] 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 18.1.5-2 uses 2014 NWI data to characterize and map Wyoming wetlands on a broad-scale. The data is not intended for site-specific analyses and is not a substitute for field-level wetland surveys, delineations, or jurisdictional determinations, which may be conducted, as appropriate, at the site-specific level once those locations are known. As shown in Figure 18.1.5-1, wetlands are found throughout the state, although palustrine and riverine wetlands tend to be more concentrated in mountainous areas. The map codes and colorings in Table 18.1.5-2 correspond to the wetland types in Figure 18.1.5-1.

Table 18.1.5-2: Wyoming Wetland Types, Descriptions, Location, and Amount, 2014

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Palustrine forested wetland	PFO	PFO wetlands contain woody vegetation that are at least 20 feet tall. Floodplain forests, hardwood swamps, and silver maple-ash swamps are examples of PFO wetlands.	Throughout the state	190,928
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.		
Palustrine emergent wetlands	PEM	PEM wetlands have erect, rooted, green-stemmed, annual, water-loving plants, excluding mosses and lichens, present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens, prairie potholes, and sloughs.	Throughout the state	702,051
Palustrine unconsolidated bottom	PUB	PUB and PAB are commonly known as freshwater ponds, and includes all wetlands with at least 25% cover of particles smaller than stones and a vegetative cover less than 30%.	Throughout the state	60,020
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,[85] and other miscellaneous wetlands are included in this group.	Throughout the state	23,106
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	46,798

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

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
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.	Around lakes throughout the state	59,580
			TOTAL	**1,082,483**

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

[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin, et al., 1979, some data has been revised based on the latest scientific advances. The USFWS uses these standards as the minimum guidelines for wetlands mapping efforts (FGDC, 2013).

[b] All acreages are rounded to the nearest whole number. The maps are prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted (USFWS, 2015b).

Palustrine Wetlands

In Wyoming, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, playas,[86] swamps, and bogs). There are several main groups of palustrine wetlands, based on their location and hydrology:

- Playas, or seasonally flooded basin wetlands are found in the plains and intermountain basins of Wyoming;
- "Kettle,[87] cirque, and moraine type wetlands and lakes are present in high elevation sites historically covered by glaciers;" and
- "Springs, bogs, and seeps are scattered throughout the state, but are most common in montane regions." (WGFD, 2010a)

Historically, wetlands covered slightly over three percent of the state, and were mostly found in playa lakebeds, riparian corridors, and glaciated montane areas. This amount was reduced to about two percent of the total surface of Wyoming, and is continuing to decline (WGFD, 2010a). Based on the USFWS NWI 2014 analysis, the most common palustrine (freshwater) wetland type in the state is PEM (72 percent), followed by PFO/PSS (20 percent), PUB/PAB (ponds) (6 percent), and other palustrine wetlands (2 percent). There are currently about 976,000 acres of palustrine (freshwater) wetlands in the state (USFWS, 2014a). The greatest threats to Wyoming's wetlands include impacts from drought and climate change, regulatory actions, and stream flow stabilization and dewatering.

[86] Playas: Seasonally flooded basins, formed in blowouts and in some cases, a result of tectonic activity. (WGFD, 2010a)

[87] Kettle Wetlands: Geomorphologically, kettle wetlands are "ice block depressions. Ice-block depressions formed when large blocks of glacial ice melted" (Cook Inlet Wetlands, 2011).

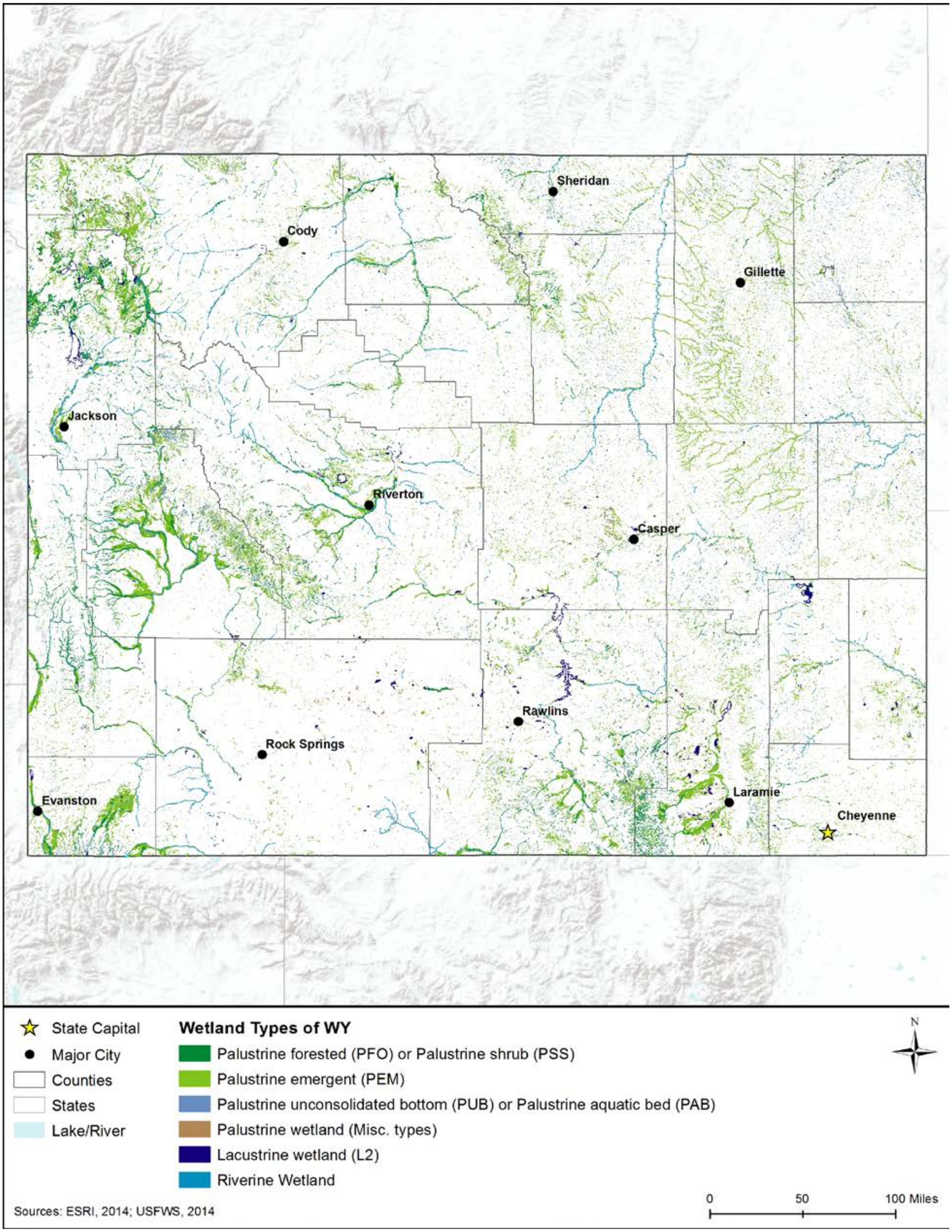


Figure 18.1.5-1: Wetlands by Type, Wyoming, 2014

Riverine and Lacustrine Wetlands

Lacustrine make up nearly six percent of all wetlands in Wyoming, and riverine make up approximately four percent of all wetlands in the state. The majority of riparian[88] wetlands are forest- and shrub-dominated (approximately 45 percent), with the remainder dominated by grasses. Characteristic riparian wetland vegetation in Wyoming includes reed canary grass *(Phalaris arundinacea)*, tufted hair grass *(Deschampsia cespitosa)*, sedges *(Cyperaceae)*, dogwood (*Cornus*), water birch *(Betula occidentalis)*, river birch *(Betula nigra)*, willows (*Salix*), and cottonwood trees (*Populus*). At one point, Riverine wetlands were the most abundant natural wetlands and open water habitats in Wyoming. Stream flow requirements, grazing practices, and other land use activities have since reduced the amounts of riverine and lacustrine wetlands in the state (WGFD, 2010a).

18.1.5.4. Wetlands of Special Concern or Value

In addition to protections under the state's Wetlands Act and national CWA, Wyoming considers certain wetland communities as areas of special value due to their global or regional scarcity, local importance, or habitat they support. Other important wetland sites in Wyoming include the following:

- The Bear River wetland complex encompasses nearly 387,000 acres, of which 52,000 acres are wetlands. The wetland complex stretches from Cokeville, Wyoming to the Utah state line, and includes both Lincoln and Uinta counties in Wyoming, and the Cokeville Meadows National Wildlife Refuge (WGFD, 2014a). The complex has a high diversity of both migratory and resident wildlife species, including sandhill cranes, breeding ducks, and geese. To learn more about this wetland complex, visit http://www.fws.gov/Refuges/profiles/index.cfm?id=65581.
- Wildlife Management Areas are designated for wildlife preservation and conservation. There are 39 WMAs in Wyoming with more than 413,000 acres of habitat. To learn more about state Wildlife Management Areas, visit https://wgfd.wyo.gov/accessto/whmas.asp.
- National Natural Landmarks range in size from nearly 300 acres to over 12,000 acres and are owned by the Bureau of Land Management (BLM), tribes, and private organizations (NPS, 2015a). Section 18.1.8, Visual Resources, describes Wyoming's National Natural Landmarks.

Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state. Easement holders include NRCS, Wyoming Game and Fish Department (WGFD), The Nature Conservancy, state land trusts, and the Rocky Mountain Elk Foundation. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), NRCS holds nearly 18,000 acres in conservation easements in Wyoming. (NCED, 2015). For more information on Wyoming's

[88] Riparian: "The area of land next to a body of water. Riparian areas form the transition between terrestrial and aquatic environments" (USEPA, 2016f).

wildlife management areas, National Natural Landmarks, conservation programs, and easements, See Section 18.1.8 Visual Resources and Section 18.1.7 Land Use, Recreation, and Airspace.

18.1.6. Biological Resources

18.1.6.1. Definition of Resource

This section describes the biological resources of Wyoming. Biological resources include terrestrial[89] vegetation, wildlife, fisheries and aquatic[90] habitats, threatened[91] and endangered[92] species as well as communities and species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Because of the significant topographic variation within the state, Wyoming supports a wide diversity[93] of biological resources ranging from the southern and middle Rockies in the south, to Yellowstone National Park in the northwest, and the great plains that dominate the middle of the state. Each of these topics is discussed in more detail below.

18.1.6.2. Specific Regulatory Considerations

The proposed project must meet the requirements of NEPA and other applicable laws and regulations. Pertinent federal laws relevant to the protection and management of biological resources in Wyoming are summarized in Appendix C, Environmental Laws and Regulations. Table 18.1.6-1 summarizes the major state laws relevant to state's biological resources.

Table 18.1.6-1: Relevant Wyoming Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Wyoming Weed and Pest Control Act	Wyoming Weed and Pest Council	Provide coordination and leadership in the fight against designated and declared noxious weeds and pests and invasive species in Wyoming.
Regulation for Importation, Possession, Confinement, Transportation, Sale and Disposition of Live Wildlife	Wyoming Game and Fish Commission	Provides protection of live wildlife within the state.
Regulation for Aquatic Invasive Species	Wyoming Game and Fish Commission	Establishes a program for detecting, preventing, and controlling aquatic invasive species.[94]

[89] Terrestrial: "Pertaining to the land." (USEPA, 2015u)
[90] Aquatic: "Pertaining to water." (USEPA, 2015u)
[91] Threatened species are "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." (16 U.S.C. §1532(20)) (USEPA, 2015u)
[92] Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range." (16 U.S.C. §1532(6)) (USEPA, 2015u)
[93] Diversity: "An ecological measure of the variety of organisms present in a habitat." (USEPA, 2015u)
[94] Invasive species: "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, 2015u)

18.1.6.3. Terrestrial Vegetation

The distribution of flora[95] within the state is a function of the characteristic geology[96,] soils, climate, and water of a given geographic area and correlates with distinct areas identified as ecoregions.[97] Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions, and represent ecosystems of regional extent. 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[98] regions of a state. In Wyoming, the three main physiographic regions include the Rocky Mountains, Great Plains, and Wyoming Basin. The ecoregions mapped by the USEPA are the most commonly referenced, although individual states and organizations have 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 Wyoming at USEPA Level III. (USEPA, 2016a) This section provides and overview of the terrestrial vegetation resources for Wyoming at USEPA Level III (USEPA, 2016b).

As shown in Figure 18.1.6-1, the USEPA divides Wyoming into seven Level III ecoregions. The seven ecoregions support a variety of different plant communities, all predicated on their general location within the state. Communities range from coniferous communities in the Rocky Mountains, to grass and shrubland communities in the Great Plains. Table 18.1.6-2 provides a summary of the general abiotic[99] characteristics, vegetative communities, and the typical vegetation found within each of the seven Wyoming ecoregions.

[95] Flora: "Plant population of a particular region" (USEPA, 2016g).
[96] 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.
[97] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables." (USEPA, 2015u)
[98] Physiographic: "The natural, physical form of the landscape." (USEPA, 2015u)
[99] 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, 2016h)

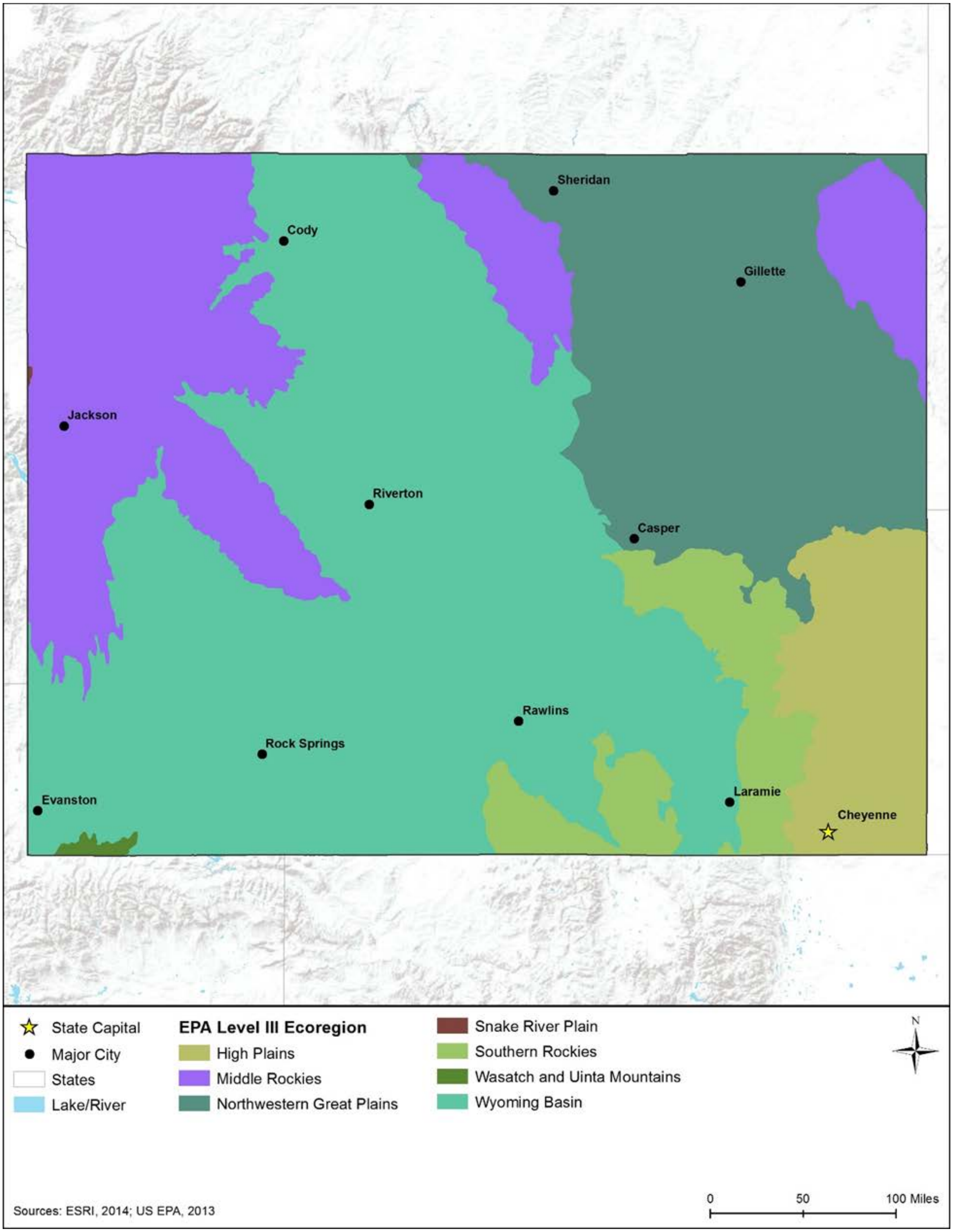


Figure 18.1.6-1. USEPA Level III Ecoregions in Wyoming

Table 18.1.6-2: USEPA Level III Ecoregions of Wyoming

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
Geographic Region: Rocky Mountains				
12	Snake River Plain	Plains and hills, with some lava fields.	Sagebrush grassland	**Shrubs** - Wyoming big sagebrush (*Artemisia tridentate*), basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*) **Forbs/Grasses -** bluebunch wheatgrass (*Pseudoroegneria spicata*), bluegrass (*Poa* spp.), basin wildrye (*Leymus cinereus*), Thurber's needlegrass (*Stipa thurberiana*), rabbitbrush (*Ericameria nauseosa*), and cheatgrass (*Bromus tectorum*)
17	Middle Rockies	Steep-crested, high mountains.	Open-canopied coniferous forest	**Conifer Trees** - Douglas fir *(Pseudotsuga menziesii)*, lodgepole pine *(Pinus contorta)*, and western white pine *(Pinus monticola)*
18	Wyoming Basin	Intermontane basin with hills and low mountains.	Grasslands and shrublands.	**Conifer Trees** - Douglas fir*(Pseudotsuga menziesii)*, lodgepole pine *(Pinus contorta)*, and western white pine *(Pinus monticola)*
19	Wasatch and Uinta Mountains	High mountains, dissected volcanic plateaus[100], and flanking valleys.	Forested vegetation and aspen parkland	**Conifer Trees -** Douglas fir *(Pseudotsuga menziesii)*, ponderosa pine *(Pinus ponderosa)*, and lodgepole pine *(Pinus contorta)*
21	Southern Rockies	Steep, rugged mountains and high elevations.	Grass or grass-shrublands at lower elevations; coniferous and alpine forest at higher elevations.	**Hardwood Trees -** quaking aspen *(Populus tremuloides)*, gambel oak *(Quercus gambelii)* **Conifer Trees –** Englemann spruce *(Picea engelmannii)*, ponderosa pine, sub-alpine fir *(Abies lasiocarpa)*, Douglas fir *(Pseudotsuga menziesii)* **Shrubs -** Sagebrush (*Artemisia* spp.), snowberry (*Symphoricarpos* spp.), mountain mahogany (*Cercocarpus* spp.) **Forbs/Grasses –** kinnickinnick (*Arctostaphyllos uva-ursi*), wheatgrass (*Pascopyrum* spp.)

[100] Plateau: "An elevated plain, tableland or flat-topped region of considerable extent." (USEPA, 2015u)

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Vegetation
Geographic Region: Great Plains				
25	High Plains	A flat, smooth grassland to slightly irregular with some natural areas, but mostly comprised of cropland. Gas and oil fields are scattered throughout the area also.	Grasslands/Semi-desert Shrublands	**Deciduous Trees -** cottonwood (*Populus* spp.) **Forbs/Grasses -** blue grama (*Bouteloua gracilis*), buffalograss (*Bouteloua dactyloides*), little bluestem (*Schizachyrium scoparium*), western wheatgrass (*Pascopyrum smithii*), fringed sage (*Artemisia frigida*)
43	Northwestern Great Plains	A semiarid[101] rolling plain of native grasslands broken up by occasional buttes[102] and badlands[103].	Native grasslands	**Shrubs –** Wyoming big sagebrush *(Artemisia tridentata)*, silver sagebrush *(Artemisia cana)*, rubber rabbitbrush *(Ericameria nauseosa)*, green rabbitbrush *(Ericameria teretifolia)*, and antelope bitterbrush *(Purshia tridentata).* **Forbs/Grasses –** western wheatgrass (*Pascopyrum smithii*), blue grama (*Bouteloua gracilis*), needle-and-thread grass *(Hesperostipa comate)*, and buffalo grass *(Bouteloua dactyloides).*

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

[101] Semi-arid land ecosystem: "The interacting system of a biological community and its non-living environmental surroundings in regions that have between 10 to 20 inches of rainfall and are capable of sustaining some grasses and shrubs but not woodland." (USEPA, 2015u)
[102] Buttes are "smaller mesas that stand conspicuously alone, but were once part of a larger mesa before erosion separated it." (NPS, 2015s)
[103] "Badlands form when soft sedimentary rock is extensively eroded in a dry climate." (NPS, 2016e)

Communities of Concern

The Wyoming Natural Diversity Database (WYNDD) at the University of Wyoming manages the Natural Heritage Program (NHP) for Wyoming. The NHP inventories, catalogues and facilitates protection of rare and outstanding elements of the natural diversity of the U.S. The WYNDD provides much of the data regarding the sensitive vegetation communities occurring within the state. Many state NHPs uses State Ranks (S1, S2, S3, and S4) to designate vegetative communities of concern. This ranking is typically based on the range of the community, the number of occurrences, the viability of the occurrences, recent trends, and the vulnerability of the community. However, WYNDD does not maintain these rankings for vegetation communities within the state (University of Wyoming, 2016).

Nevertheless, the 2010 Wyoming State Wildlife Action Plan (SWAP), prepared by the WGFD, has designated 11 vegetative communities as priority habitats for conservation in the state (WGFD, 2010b). Wyoming Appendix A, Table A1 Biological Resources, summarizes the 11 terrestrial priority habitat types found in the state.

Nuisance and Invasive Plants

There are a large number of undesirable plant species that are considered nuisance and invasive plants that are non-native to areas with the potential to spread causing harm to the environment, local economy, and human health. Noxious weeds[104] are typically non-native species that have been introduced into an ecosystem inadvertently; however, on occasion native species can be considered a noxious weed. Noxious weeds greatly affect agricultural areas, forest management, natural, and other open areas (Government Printing Office, 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 U.S., 88 of which are terrestrial, 19 aquatic, and five parasitic (USDA, 2015b).

Noxious weeds are a threat to Wyoming's rangeland,[105] cropland, pastureland,[106] forests, and wildlands. Noxious weeds can have adverse ecological and economic impacts to these resources by displacing native species, degrading wildlife habitat, and increasing soil erosion[107] (NPS, 2005). The Wyoming Weed and Pest Control Act stipulates that the Wyoming Department of Agriculture, in coordination with the Wyoming Weed and Pest Council, shall implement and pursue an effective program for the control of designated weeds and pests (Wyoming Weed and Pest Council, 2015). Further, individual counties in Wyoming may also develop a list of noxious

[104] Noxious weed: "any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment." (Animal and Plant Health Inspection Service, 2000)
[105] Rangeland: "A Land cover/use category on which the climax or potential plant cover is composed principally of native grasses, grasslike plants, forbs or shrubs suitable for grazing and browsing, and introduced forage species that are managed like rangeland." (USEPA, 2015u)
[106] Pastureland: "Land used primarily for the production of domesticated forage plants for livestock." (USEPA, 2015u)
[107] Erosion: "The general process or the group of processes whereby the materials of Earth's crust are loosened, dissolved, or worn away and simultaneously moved from one place to another, by natural agencies, which include weathering, solution, corrosion, and transportation." (USEPA, 2015u)

weeds to be regulated at the county level. A total of 30 state-listed terrestrial noxious weeds are regulated in Wyoming, none of which occur on the Federal Noxious Weed List (USDA, 2016).

- **Shrubs –** Saltcedar *(Tamarix spp.)*.
- **Terrestrial Forbs and Grasses –** field bindweed *(Convolvulus arvensis*), Canada thistle *(Cirsium arvense),* leafy spurge *(Euphorbia esula),* perennial sowthistle *(Sonchus arvensis),* quackgrass *(Agropyron repens),* hoary cress *(Cardaria draba* and *Cardaria pubescens),* perennial pepperweed *(Lepidium latifolium),* houndstongue (*Cynoglossum officinale*), ox-eye daisy *(Chrysanthemum leucanthemum),* skeletonleaf bursage *(Franseria discolor),* Russian knapweed *(Acroptilon repens),* yellow toadflax *(Linaria vulgaris),* dalmatian toadflax *(Linaria dalmatica),* scotch thistle *(Onopordum acanthium),* musk thistle *(Carduus nutans),* common burdock *(Arctium minus),* plumeless thistle *(Carduus acanthoides),* Dyer's woad *(Isatis tinctoria),* houndstongue *(Cynoglossum officinale),* spotted knapweed *(Centaurea maculosa),* diffuse knapweed *(Centaurea diffusa),* purple loosestrife *(Lythrum salicaria),* common St. Johnswort *(Hypericum perforatum),* common tansy *(Tanacetum vulgare),* and Dyer's woad (*Isatis tinctoira*).

18.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Wyoming, divided among mammals,[108] birds,[109] reptiles[110] and amphibians,[111] and invertebrates.[112] Terrestrial wildlife consists of those species, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals and furbearers, nongame animals, and game birds, waterfowl, and migratory birds and their habitats within Wyoming. A discussion of non-native or invasive wildlife species is also included. Information regarding the types and location of native and non-native/invasive wildlife is useful for assessing the importance of any impacts to these resources or the habitats they occupy. According to WGFD, the state is home to 120 mammal species, 27 reptile species, 12 amphibian species, and 426 bird species. (WGFD, 2010b)

Mammals

Common and widespread mammalian species in Wyoming include the mule deer *(Odocoileus hemionus),* white-tailed deer *(Odocoileus virginianus),* and elk (*Cervus canadensis*). Most mammals are widely distributed in the state; however, there are some species, such as the big horn sheep and mountain goat that are found primarily in the mountainous areas in the western portion of the state (WGFD, 2010b). A number of threatened and endangered mammals are

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

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

[110] Reptile: "Cold-blooded, air-breathing vertebrates belonging to the class Reptilia, usually covered with external scales or bony plates." (USEPA, 2015u)

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

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

located in Wyoming. Section 18.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

In Wyoming, antelope (*Antilocapra americana*), white-tailed deer, mule deer, elk, moose (*Alces americanus*), bighorn sheep, and mountain goats are classified as big game species, whereas small game species include small mammals (e.g., squirrels and rabbits), furbearers (e.g., badgers and weasels), and migratory game birds (WGFD, 2015a) (WGFD, 2015e).

Wyoming has identified 51 mammals as Species of Greatest Conservation Need (SGCN) (WGFD, 2016a). The SGCN list consists of at-risk species that are rare or declining, and can provide funding from State Wildlife Grants for efforts to reduce their potential to be listed as endangered. Although these species have been targeted for conservation, they are not currently under legal protection. The SGCN list is updated periodically and is used by the state to focus their conservation efforts and as a basis for implementing their SWAP (WGFD, 2010b).

Birds

The number of native bird species documented in Wyoming varies according to the timing of the data collection effort, changes in bird taxonomy,[113] and the reporting organization's method for categorizing occurrence and determining native versus non-native status.

As of 2010, 426 species of birds have been documented in Wyoming. Among these bird species, Wyoming has identified 80 SGCN species (WGFD, 2010b) (WGFD, 2016a).

Wyoming is located within both the Central and Pacific Flyways. Covering the eastern three quarters of Wyoming, the Central Flyway occurs from the Gulf Coast of Texas to the Canadian boreal forest (USFWS, 2016a). The Pacific Flyway covers the western quarter of Wyoming, west of the continental divide, and spans from the west coast of Mexico to the arctic (USFWS, 2016b). Large numbers of migratory birds utilize these flyways and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall (Pocewicz et al., 2013). "The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations" (USFWS, 2013a). The USFWS is responsible for enforcing the MBTA and maintaining the list of protected species. The migratory bird species protected under the MBTA are listed in 50 CFR 10.13 (USFWS, 2013a).

Bald eagles *(Haliaeetus leucocephalus)* and golden eagles *(Aquila chrysaetos)* are protected under the Bald and Golden Eagle Protection Act. Bald eagles are generally found near large rivers and lakes in the entire state all year (eBird, 2015). Golden eagle can also be found year round in a variety of habitat types; however, this species typically nests in mountains and cliffs.

A number of Important Bird Areas (IBA) have also been identified in Wyoming, as can be seen in Figure 18.1.6-2. The IBA program is an international bird conservation initiative with a goal

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

of identifying the most important places for birds, and to conserve these areas. These IBAs are identified according to standardized, scientific criteria through a collaborative effort among state, national, and international conservation-oriented non-governmental organizations (NGOs), state and federal government agencies, local conservation groups, academics, grassroots environmentalists, and birders. These IBAs link global and continental bird conservation priorities to local sites that provide critical habitat for native bird populations. IBA priority areas are based on a number of specific criteria. Generally, global IBAs are sites determined important for globally rare species or support bird populations at a global scale. Continental IBAs are sites determined important for continentally rare species or support bird populations at a continental scale, but do not meet the criteria for a global IBA. State IBAs are sites determined important for state rare species or support local populations of birds. (National Audubon Society, 2016)

According to the Rockies Audubon Society (RAS), a total of 44 IBAs, covering approximately nine million acres, have been identified in Wyoming, including breeding range,[114] migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as native grasslands, grasslands, sage brush, and wetland/riparian[115] areas. These IBAs are widely distributed throughout the state, although the largest concentration of IBAs are located in the central and western regions of the state, within the Great Plains and Rocky Mountains (National Audubon Society, 2015). The Red Desert covers approximately 4.5 million acres in central Wyoming and provides habitat for bald eagle, golden eagle, greater sage-grouse (*Centrocercus urophasianus*), Canada goose (*Branta canadensis*), and a number of hawks, sparrows, and wetland bird species (WGFD, 2014b). Section 18.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies the protected bird species of Wyoming.

[114] Breeding range: "The area utilized by an organism during the reproductive phase of its life cycle and during the time that young are reared." (USEPA, 2015u)
[115] Riparian: "Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands." (USEPA, 2015u)

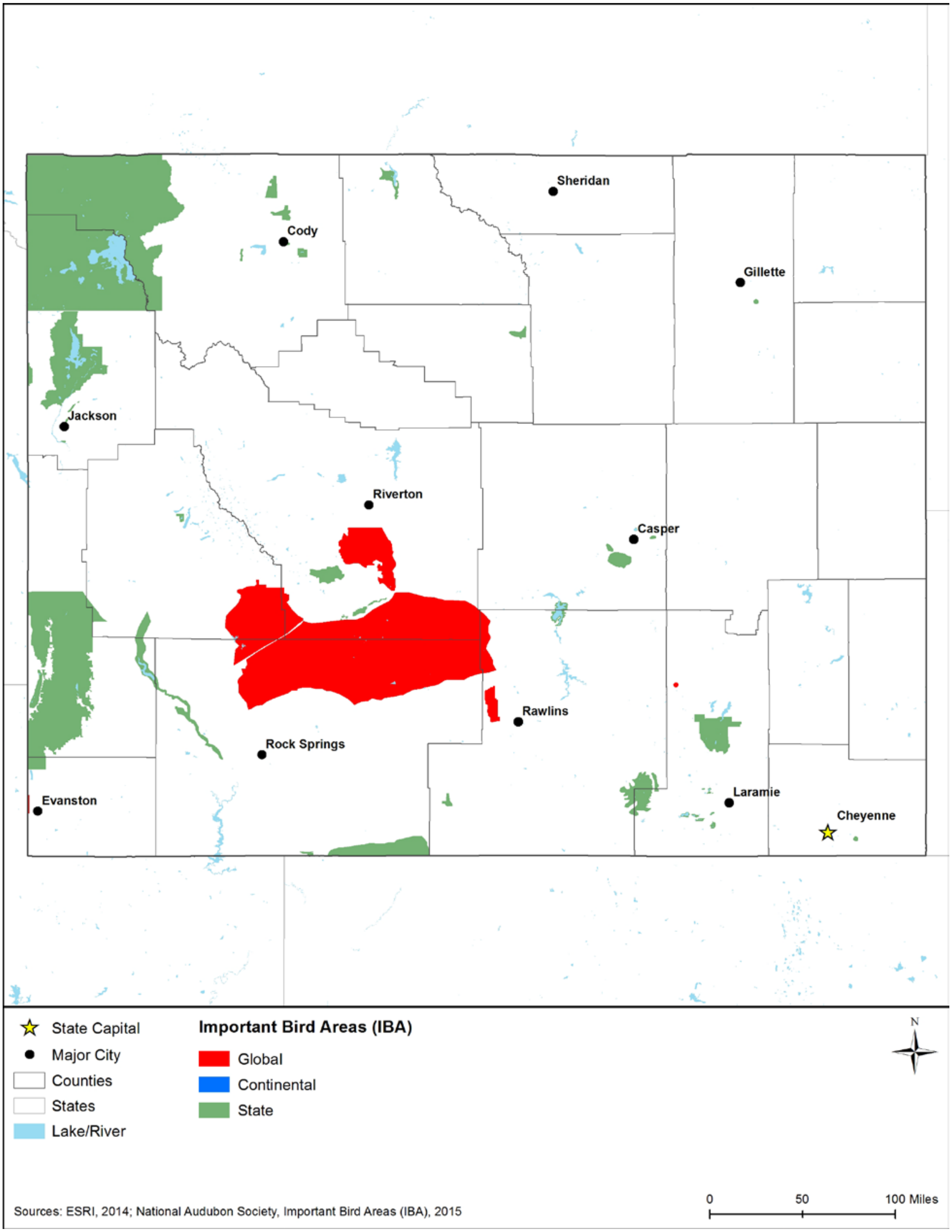


Figure 18.1.6-2: Important Bird Areas in Wyoming

Reptiles and Amphibians

A total of 27 reptile and 12 amphibian species are known to occur within Wyoming (WGFD, 2010b). These species occupy a wide variety of habitat types, from the arid plains in the east to the moist coniferous forests of the west. Very few species are widespread throughout the state; instead, most species are commonly found in either the plains region in the east or the mountainous region in the west (WGFD, 2010b). Several species of mole salamanders and the wood frog are known to seasonally migrate in Wyoming. These amphibians often travel by the hundreds on their migration pathway that often crosses roadways. Mole salamanders are typically found in burrows in the forest floor (Montana Field Guide, 2015). In Wyoming, wood frogs use diverse vegetation types from willow thickets and wet meadows to water environments, such as beaver ponds or small lakes, and slow moving streams (WGFD, 2010c). After they emerge from dormancy, wood frogs are documented migrating up 900 feet to breeding pools, where they breed rapidly in early spring in permanent or ephemeral water (Homan, Atwood, Dunkle, & Karr, 2010). However, a small percentage of juvenile wood frogs could migrate over 1.5 miles from natal ponds, suggesting juveniles may be capable of migrating relatively long distances (Berven & Grudzien, 1990). Of the 39 native reptile and amphibian species, 33 have been identified as SGCN (WGFD, 2016a).

Invertebrates

Wyoming is home to approximately 10,000 species of invertebrates, including a wide variety of bees, hornets, wasps, butterflies, moths, beetles, flies, dragonflies, damselflies, spiders, mites, and nematodes. These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. In the United States, one third of all agricultural output depends on pollinators.[116] 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. "By helping to keep plant communities healthy and able to reproduce naturally, native pollinators assist plants in providing food and cover for wildlife, preventing erosion, and keeping waterways clean" (NRCS, 2005). In Wyoming, terrestrial invertebrates are not legally considered wildlife, but in order to increase understanding of this critical group, the WGFD signed a cooperative agreement with the WYNDD in 2010 (WGFD, 2010b).

Invasive Wildlife Species

Wyoming has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, or introduction of select plant and aquatic species. However, the state does not have regulations for terrestrial wildlife species. Some nonnative species are considered nuisance species, such as mule deer, white-tailed deer, mute swan, prairie dogs (*Cynomys* spp.), antelope, Canada geese (*Branta canadensis*), the American alligator (*Alligator mississippiensis*), byrmese python (*Python molurus bivittatus*), and red-eared slider (*Trachemys scripta elegans*), and have been found in Wyoming (WGFD, 2016b) (WGFD, 2015b). The mountain pine beetle (*Dendroctonus ponderosae*) is identified as a state-designated pest under Wyoming Statute 11-5-

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

102(a)(xii) (Wyoming Department of Agriculture, 2016). Invasive insects in particular pose a large threat to Wyoming's forest and agricultural resources. Species such as the gypsy moth, Asian longhorn beetle, and emerald ash borer are of particular concern in Wyoming and are known to cause irreversible damage to native forests.

Invasive wildlife species are important to consider when proposing a project since project activities may result in conditions that favor the growth and spread of invasive wildlife populations. These situations may result from directly altering the landscape or habitat to a condition that is more favorable for an invasive species, or by altering the landscape or habitat to a condition that is less favorable for a native species.

18.1.6.5. Fisheries and Aquatic Habitats

This section discusses the aquatic wildlife species in Wyoming, including freshwater fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented in this section. A distinctive feature of the Wyoming landscape with regard to aquatic wildlife is the cold water trout streams and rivers west of the continental divide. These water bodies, often fed by snowmelt, provide habitat for a variety of aquatic wildlife that require a high dissolved oxygen content and clear waters (low sediment load) (Colorado River Water Users Association, 2016). No essential fish habitat (EFH) identified by the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) exists in Wyoming (NOAA, 2016). Critical habitat for threatened and endangered fish species, as defined by the Endangered Species Act (ESA), does exist within Wyoming and is discussed in Section 18.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Freshwater Fish

Wyoming is home to breeding populations of more than 78 species of freshwater fish, ranging in size from small darters and minnows to larger species such as salmon and sturgeon. These species are grouped into 13 families, as follows: bullheads/catfishes, burbot, drums, killifishes, livebearers (mosquito fish and sword tails), minnows, mooneyes, perches, pikes/pickerels, sculpins, sturgeons, suckers, sunfishes, temperate basses, and trout. A brief description of those families that contain common species, notable sport fish species, or species of concern is listed below (WGFD, 2010b).

The bullheads/catfishes family includes three species, which include the channel catfish *(Ictalurus punctatus),* stone-cat *(Noturus flavus),* and black bullhead *(Ameiurus melas).* The channel catfish prefers large rivers and lowland lakes and is native to the Missouri River drainage, but has been widely introduced elsewhere. The stonecat and black bullhead are smaller members of the catfish family that rarely reach an adequate size to be targeted by fisherman. (WGFD, 2010b)

The burbot *(Lota lota)* is the only species in the burbot family found in Wyoming. This fish is found in large streams and cold deep lakes and reservoirs. In Wyoming, burbot is native to the Wind-Big Horn, Tongue and Clark's Fork drainages. The burbot is listed as a SGCN in Wyoming. (WGFD, 2010b)

Approximately 27 species of minnows occur in Wyoming. Common minnow species in Wyoming include the fathead minnow *(Pimephales promelas),* flathead chub *(Platygobio gracilis),* emerald shiner *(Notropis atherinoides),* longnose dace *(Rhinichthys cataractae),* and lake chub *(Couesius plumbeus).* This family contains 16 SGCN, with the highest priority species including the Kendall warm springs dace *(Rhinichthys osculus thermalis),* roundtail chub *(Gila robust),* sturgeon chub *(Macrhybopsis gelida),* and northern leatherside chub *(Lepidomeda copei).* Medium priority species include the finescale dace *(Phoxinus neogaeus),* hornyhead chub *(Nocomis biguttatus),* pearl dace *(Margariscus margarita),* suckermouth minnow *(Phenacobius mirabilis),* western silvery minnow *(Hybognathus argyritis),* plains minnow *(Hybognathus placitus),* and plains topminnow *(Fundulus sciadicus).* Lowest priority species include the brassy minnow *(Hybognathus hankinsoni),* common shiner *(Luxilus cornutus),* flathead chub *(Platygobio gracilis),* central stoneroller *(Campostoma anomalum),* and bigmouth shiner *(Notropis dorsalis)*. The Kendall warm springs dace is also federally listed as endangered. (WGFD, 2010b)

A total of six species of perches occur in Wyoming, including the yellow perch (*Perca flavescens*), walleye (*Sander vitreus*), sauger (*Sander canadensis*), Iowa darter (*Etheostoma exile*), Johnny darter (*Etheostoma nigrum*), and orangethroat darter (*Etheostoma spectabile*). Wyoming's most important perch fisheries include Glendo and Boysen reservoirs, Lake Hattie, and Lake DeSmet. Walleye are important game fish that are not native to Wyoming. Sauger are native to the Missouri River drainage and are listed as a SGCN in Wyoming. The Iowa darter and orangethroat darter are SGCN in Wyoming. (WGFD, 2010b)

Two species of pikes/pickerels occur in Wyoming's waters: the northern pike (*Esox lucius*) and tiger musky (*Esox masquinongy* x *Esox lucius*). The tiger musky is a hybrid cross between muskellunge and northern pike. The northern pike was introduced into Keyhole Reservoir, which is the only water the WGFD currently manages for this species. Northern pike prefer large lakes and reservoirs with an abundance of forage fish. (WGFD, 2010b)

The sturgeon family is comprised of one species in Wyoming, the shovelnose sturgeon. The shovelnose sturgeon is an SGCN in Wyoming. Shovelnose sturgeon are primarily found in Wyoming's Big Horn Lake and lower Big Horn River. (WGFD, 2010b)

The sucker family includes seven species in Wyoming. Common and widespread species include the longnose sucker *(Catostomus catostomus),* the white sucker *(Catostomus commersonii),* and the river carpsucker *(Carpiodes carpio).* The blue sucker *(Cycleptus elongates)* and flannelmouth sucker *(Catostomus latipinnis*) are SGCN in Wyoming. (WGFD, 2010b)

The sunfish family includes eight species, many of which are highly popular with sport fishermen. The most commonly encountered species are the bluegill *(Lepomis macrochirus),* black crappie *(Pomoxis nigromaculatus),* white crappie *(Pomoxis annularis),* largemouth bass *(Micropterus salmoides*), and smallmouth bass *(Micropterus dolomieu).* These sunfish species live in a wide variety of habitats, including rocky, cool lakes streams, and reservoirs. (WGFD, 2010b)

Wyoming has 14 species in the trout family. Some of the most common are brook trout *(Salvelinus fontinalis),* brown trout (*Salmo trutta*), and rainbow trout *(Oncorhynchus mykiss).* These species are among the most popular game fish in Wyoming. They occupy the cold water streams and mountain lakes throughout the state. The trout family also contains five SGCN, the Colorado River cutthroat trout *(Oncorhynchus clarki pleuriticus),* Yellowstone cutthroat trout *(Oncorhynchus clarkii bouvieri),* Bonneville cutthroat trout *(Oncorhynchus clarki utah),* Snake River cutthroat trout *(Oncorhynchus clarkii behnkei),* and the mountain whitefish *(Prosopium williamsoni*). (WGFD, 2010b)

Shellfish and Other Invertebrates

Wyoming is still in the discovery phase in terms of its freshwater mussels and gastropods, but research has intensified in recent years led by the WGFD. Seven species of native mussels were known to inhabit Wyoming water as of late 2010, while 14 entries are listed as SGCN. These species include the Jackson Lake springsnail *(Pyrgulopsis robusta),* oreohelix mountain snail *(Oreohelix* spp.), aquatic snails, California floater *(Anodonta californiensis),* cave physa *(Physella spelunca),* cylindrical papershell *(Anodontoides ferussacianus),* fatmucket, giant floater, land snails and slugs, plain pocketbook *(Pyganodon grandis),* western pearlshell *(Margaritifera falcate),* white heel splitter *(Lasmigona complanata),* pill clams *(Pisidium* spp.), and pond snails. There are also five entries of crustaceans listed as SGCN, including pilose crayfish *(Pacifastacus gambelii),* calico crayfish *(Orconectes immunis),* devil crayfish *(Cambarus diogenes),* ringed crayfish *(Orconectes neglectus),* and shrimp. (WGFD, 2010b)

Invasive Aquatic Species

As previously discussed, Wyoming has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase and introduction of select invasive species, both plants and animals (WGFD, 2014c). WGFD maintains a priority aquatic invasive species. This list includes zebra mussel *(Dreissena polymorpha*), quagga mussel *(Dreissena rostriformis),* rusty crayfish *(Orconectes rusticus),* bighead carp *(Hypophthalmichthys nobilis),* silver carp *(Hypophthalmichthys molitrix),* black carp *(Mylopharyngodon piceus),* viral hemorrhagic septicemia *(Novirhabdovirus* spp.), and hydrollia *(Hydrilla verticillata*). Additional species of concern include the Asian *clam (Corbicula fluminea*), brook stickleback *(Culaea inconstans),* snakehead, and whirling disease (WGFD, 2010b). Additional high profile invasive aquatic plants include Eurasian watermilfoil *(Myriophyllum spicatum),* curly pondweed *(Potamogeton crispus),* and didymo *(Didymosphenia geminate).*

18.1.6.6. Threatened and Endangered Species and Species of Conservation Concern

The USFWS is responsible for administering the federal Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.) in Wyoming. The USFWS has identified four federally endangered and eight federally threatened species known to occur in Wyoming (USFWS, 2015c). Of these 12 federally listed species, four of them have designated critical habitat[117] (USFWS, 2015d).

Figure 18.1.6-3 depicts the critical habitat in Wyoming for these species. Two candidate species[118] 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). The 12 federally listed species and two candidate species include five mammals, one bird, one fish, one amphibian, and four plants (USFWS, 2015c) and are discussed in detail under the following sections.

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

[117] Critical habitat includes "the specific areas (i) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species." (16 U.S.C. § 1532(5)(A)) (USEPA, 2015u)
[118] 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)

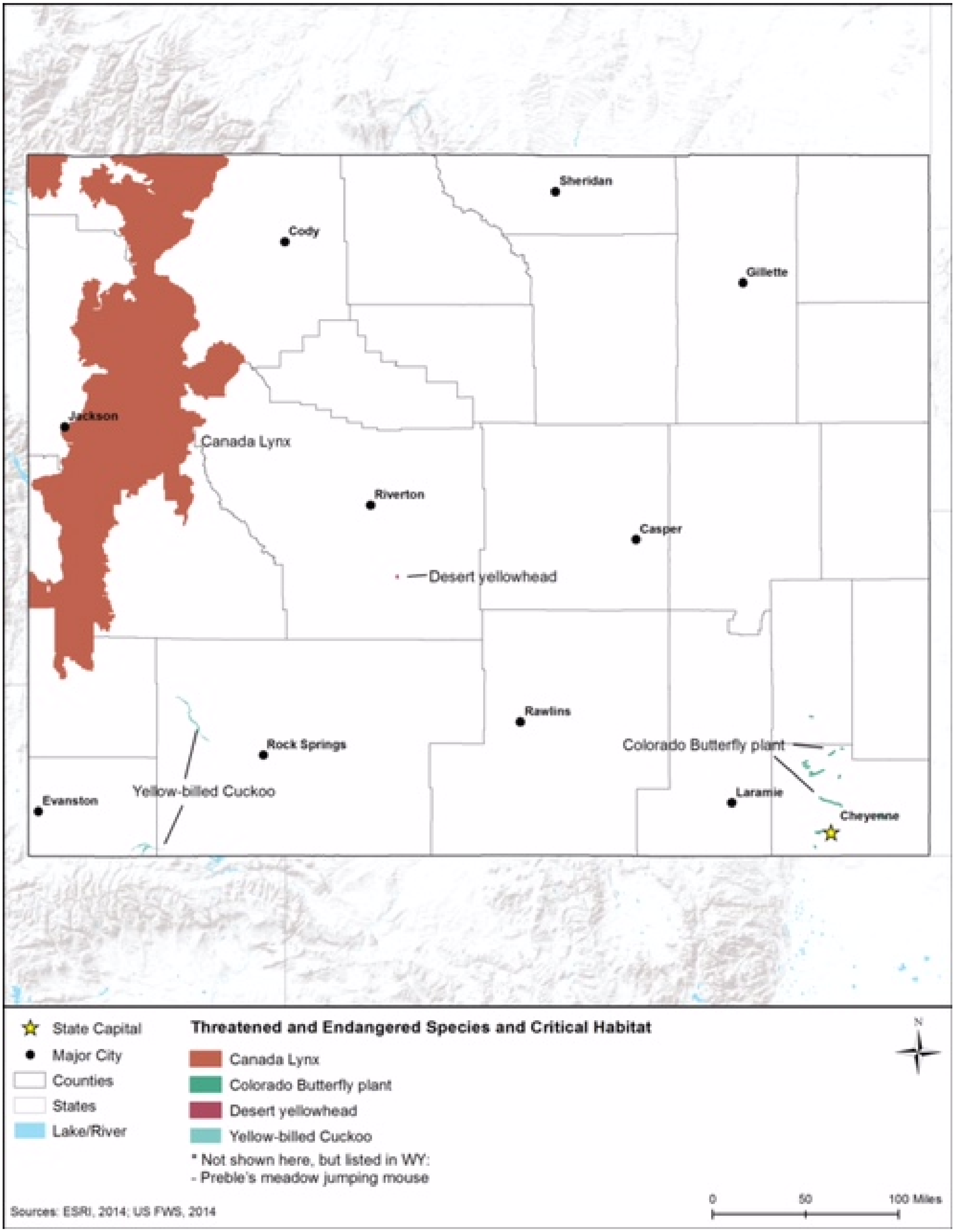


Figure 18.1.6-3: Critical Habitat in Wyoming

Mammals

One endangered and four threatened mammals are federally listed in Wyoming as summarized in Table 18.1.6-3. The Canada Lynx (*Lynx Canadensis)* and the grizzly bear (*Ursus arctos horribilis)* may be found the Rocky Mountains of northwestern parts of the state (USFWS, 2015f) (USFWS, 2015g). The black-footed ferret (*Mustela nigripes)* is generally located in western prairies of the state, and the Preble's meadow jumping mouse *(Zapus hudsonius preblei)* may be found in riparian grasslands of southeastern Wyoming (USFWS, 2010a) (USFWS, 2015k). The Northern long-eared bat is known to occur in the eastern part of Wyoming (USFWS, 2016c). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Wyoming is provided below.

Table 18.1.6-3: Federally Listed Mammal Species of Wyoming

Common Name	Scientific Name	Federal Status[a]	Critical Habitat in Wyoming	Habitat Description
Black-footed Ferret	*Mustela nigripes*	E/XN	No	Found in prairie dog complexes of western Wyoming.
Canada Lynx	*Lynx Canadensis*	T	Yes; in portions of five counties.	Found in spruce/fir forests of the Rocky Mountains in northwestern parts of the state.
Grizzly Bear	*Ursus arctos horribilis*	T	No	Occurs in alpine/subalpine coniferous forests of the Rocky Mountains in northwestern parts of the state.
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Trees and snags, caves, and abandoned mines; found in eastern part of the state.
Preble's Meadow Jumping Mouse	*Zapus hudsonius preblei*	T	Yes; adjacent to the North and South Platte Rivers.	Found near a complex of riparian zones near streams and drainages and undeveloped upland grasslands of southeastern Wyoming.

[a] E = Endangered, T = Threatened, XN = Non-Essential Experimental Population,

Source: (USFWS, 2015c)

Black-footed Ferret. The black-footed ferret is a member of the weasel family; it is a "slender, wiry animal with black feet, a black face mask, and black-tipped tail" that ranges from 18 to 24 inches in length and 1.5 to 2.5 pounds (USFWS, 2015h). The ferret was first listed as endangered under early endangered species legislation in 1967 (32 Federal Register [FR] 4001, March 11, 1967) and was incorporated into the ESA as an endangered species (16 U.S.C. § 1531 et seq.). In 1986, only 18 individuals were known to exist within its range. The last remaining individuals in the wild were captured near Meeteetse, Wyoming, and were used to develop experimental

Black-footed Ferret Photo Credit: USFWS populations in Arizona, Colorado, Montana, South Dakota, Utah, and Wyoming. Based on 2001 USFWS population estimates, there were "more than 1,000 black-footed ferrets in the wild and another 280 living in breeding facilities" (USFWS, 2010a).

Suitable habitat for the black-footed ferret consists of native grasslands inhabited by prairie dogs. The survival of black-footed ferrets is directly connected to prairie dog abundance and habitat, as prairie dog burrows are used for shelter as well as dens to rear their young. In addition, over 90 percent of the black-footed ferret's diet is composed of prairie dogs. The primary causes for this species' near extinction was the loss of habitat and prey resulting from conversion of prairies to agriculture or other uses, and prairie dog eradication programs. (USFWS, 2010a) (USFWS, 2013b)

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 (*Lynx rufus*) (USFWS, 2013c). This cat inhabits boreal (northern) 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. Only a few places in the lower 48 states regularly support the Canada lynx populations. This species was federally listed as threatened in 2000 (65 FR 16053 16086, March 24, 2000). Critical habitat was designated for this species in 2014 (79 FR 54781 54846, September 12, 2014), which includes areas located in Fremont, Lincoln, Park, Sublette and Teton counties (USFWS, 2015f).

Canada Lynx. Photo Credit: USFWS

The Canada lynx was listed in 2000 primarily due to concerns with regard to habitat destruction, and 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. While incidental take of lynx from hunting or trapping is possible, available data does not indicate this to be a cause for low species densities. (USFWS, 2005) (USFWS, 2013c)

Grizzly Bear Photo Credit: USFWS

Grizzly Bear. The grizzly bear, also known as the brown bear, is differentiated from a black bear by its higher, rounded shoulders, concave face, and claws that are longer and curved. The fur ranges in color from light brown to almost black, and males can grow to be 7 feet tall and weigh from 300 to 600 pounds (females weigh between 200 and 400 pounds) (USFWS, 2007). The grizzly bear was federally listed as threatened in 1975 (40 Federal Register 145, July 28, 1975).

This species is found in Idaho, Montana, Washington, and Wyoming in the conterminous U.S. within five distinct population areas (Servheen, 1993) (USFWS, 2007). In Wyoming, this species can be found in areas along the upper northwestern portion of the state including Fremont, Hot Springs, Lincoln, Park, Sublette and Teton counties (USFWS, 2015g). 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, 2007). The primary threats to this species include conflicts with humans, such as livestock depredation or unregulated hunting, and habitat loss or fragmentation from various types of development ranging from new roads, logging, energy and mineral exploration, and recreation (Servheen, 1993) (USFWS, 2007).

Northern Long-eared Bat. The threatened northern long-eared bat (*Myotis septentrionalis*) is a brown furred, insectivorous bat with long ears. This bat is medium-sized, relative to other members of the genus *Myotis*, reaching a total length of 3 to 3.7 inches in length (USFWS, 2015i). The Northern long-eared bat was listed as endangered in 2013 (78 FR 72058 72059, December 2, 2013) and was relisted as threatened in 2015 (80 FR 17973 18033, April 2, 2015). In Wyoming, the Northern long-eared bat is known to occur in three counties in Campbell, Crook, and Weston counties in the eastern portion of the state (USFWS, 2015j).

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

White Nose Syndrome is the leading cause for the decline of this species. The numbers of northern long-eared bats in hibernacula has decreased by 99 percent in the northeast U.S. (USFWS, 2015j). Other threats include temperature or air flow impacts to their hibernating habitat, forest management practices that are incompatible with this species' habitat needs, habitat fragmentation, and wind farm operations (USFWS, 2015i).

Preble's Meadow Jumping Mouse. The Preble's meadow jumping mouse is a small rodent with long hind legs and tails, large feet, and average between 7 to 10 inches long. Their tails make up about 60 percent of their overall length. Preble's meadow jumping mouse was federally listed as threatened in 1998 (63 FR 26517 26530, May 13, 1998). This mouse is a habitat specialist and inhabits riparian zones near undisturbed upland grasslands and water. Habitat contains riparian zones with shrubs, grasses, and woody debris. Upland habitat is also essential to Preble's meadow jumping mouse, as the species has been found to use areas 330 feet from the 100-year floodplain of a watercourse. Preble's meadow jumping mouse can be found in the lower southeastern portion of the state, including areas within Albany, Laramie, Converse, Platte and Goshen counties. (USFWS, 2003) (USFWS, 2014c) (USFWS, 2015k) Critical habitat for this species has been designated for "river and stream reaches and adjacent areas in the North Platte River and South Platte River" (68 FR 37276, June 23, 2003).

Major threats to this species include degradation, fragmentation, loss, and alteration of habitat. Habitat changes are likely due to residential, commercial, recreational, flood control, and water development and agricultural land uses. Other development that could impact the continued existence of the species includes hazardous materials, mining, and highway and bridge construction. Natural events such as flooding, predation, and disease have also impacted the remaining Preble's populations in the state (USFWS, 1998).

Birds

One threatened bird species are federally listed for Wyoming, as summarized in Table 18.1.6-4. Information on the habitat, distribution, and threats to the survival and recovery of this species in Wyoming is provided below.

Table 18.1.6-4: Federally Listed Bird Species of Wyoming

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Wyoming	Habitat Description
Western Yellow-billed Cuckoo	*Coccyzus americanus*	T	Yes; within Unita and Sweetwater counties, Wyoming.	Occurs in riparian, forested habitat. Found in 7 counties in the southwestern half of Wyoming.

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

Yellow-billed Cuckoo (Western). The western yellow-billed cuckoo is approximately 12 inches in length. The cuckoo migrates to South America in the winter and returns to breed in the western U.S. The western yellow-billed cuckoo is considered a separate population from its eastern counterpart (USFWS, 2016d). Currently, the western yellow-billed cuckoo is only known to breed in Arizona, California, Colorado, Idaho, New Mexico, and Utah (USFWS, 2014d) (USFWS, 2016d). This species was federally listed as threatened in 2014 (79 FR 67154 67155, November 12, 2014). In 2014, the western distinct population segment of the yellow-billed cuckoo was designated critical habitat in the southwestern portion of the country, including Wyoming. Designated critical habitat areas for the yellow-billed cuckoo in Wyoming include areas within Unita and Sweetwater counties (79 FR 71373 71375, December 2, 2014) (USFWS, 2014e). In Wyoming, it is known or believed to occur in seven counties in the southwestern half of the state (USFWS, 2015l).

Preferred habitat consists of riparian forested habitat dominated by cottonwood and willow trees. "Western yellow-billed cuckoos rarely nest at sites less than 50 acres in size, and sites less than 37 acres are considered unsuitable habitat" (USFWS, 2014e). 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, conversion of land to other uses, pesticide use, and climate change (warmer temperatures) are considered the primary threats to this species (USFWS, 2014e) (USFWS, 2016d).

Fish

One endangered fish species is federally listed in Wyoming as summarized in Table 18.1.6-5. The Kendall warm springs dace can be found in the Green River of Bridger-Teton National Park, western Wyoming (USFWS, 2013d). Information on the habitat, distribution, and threats to the survival and recovery of this species in Wyoming is provided below.

Table 18.1.6-5: Federally Listed Fish Species of Wyoming

Common Name	Scientific Name	Federal Status[a]	Critical Habitat in Wyoming	Habitat Description
Kendall Warm Springs Dace	*Rhinichthys osculus thermalis*	E	No	This species occurs in one thermal-fed stream located near Green River in the Bridger-Teton National Park, in Sublette and Teton Counties, western Wyoming.

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

Kendall Warm Springs Dace. The Kendall warm springs dace is a small greenish-gray fish with dark blotches and dark lateral stripes on its side. Adults are typically 1 to 2 inches in length and spawning occurs several times a year in shallow pools approximately one foot deep. The Kendall warm springs dace are the "only fish species to inhabit the 85° F spring water in the Bridger-Teton National Park in Wyoming" (USFWS, 2013d). This species was federally listed as endangered in 1970 under the Endangered Species Preservation Act of 1996 (35 FR 16047 16048; October 13, 1970). In Wyoming, it is known or believed to occur in Sublette and Teton counties, in the western part of the state (USFWS, 2015m).

The Kendall Warm Springs Dace fish species is located in the Bridger-Teton National Forest near the Green River. "The spring area and 984 feet of stream comprise the total habitat for this species" (USFWS, 2013d). Primary threats to this species include water table lowering, habitat loss due to manipulation or pollution of the aquifer, species collection, and the potential introduction of non-native species (USFWS, 2013d).

Amphibians

One endangered amphibian species is federally listed in Wyoming as summarized in Table 18.1.6-6. The Wyoming toad occurs at the Mortenson Lake National Wildlife Refuge, southeastern Wyoming (USFWS, 2015n). Information on the habitat, distribution, and threats to the survival and recovery of this species in Wyoming is provided below.

Table 18.1.6-6: Federally Listed Amphibian Species of Wyoming

Common Name	Scientific Name	Federal Status[a]	Critical Habitat in Wyoming	Habitat Description
Wyoming Toad	*Anaxyrus baxteri*	E	No	Occurs in the Laramie Plains, specifically at the Mortenson Lake National Wildlife Refuge, Albany County, southeastern Wyoming.

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

Wyoming Toad. The Wyoming Toad is a small, brownish toad with a humped ridge head and a body that is covered in lumps and warts. Adults are approximately 2 inches in length and breed in late spring and early summer. This species was federally listed as endangered in 1984 (49 FR 1992 1994, January 17, 1984) and is considered one of the four most endangered amphibian species in North America. The last 10 Wyoming toads known to exist were captured for breeding in 1989 (USFWS, 2015p). This species is known or believed to occur in Albany County, in southeastern Wyoming (USFWS, 2015n).

Historically, suitable habitat for this species was floodplains, ponds, and small seepage lakes. Today, suitable habitat for this species is limited to the Laramie Plains located at the Mortenson Lake National Wildlife Refuge (USFWS, 2014f). Currently, all Wyoming toads located at the Laramie Plains are a result of captive breed releases. Captive breeding occurs in facilities at the Saratoga National Fish Hatchery and Sybille Wildlife Research Center in Wyoming (USFWS, 2015o). Primary threats to this species include limited distribution, lack of suitable habitat for reintroduction and diseases from pathogenic fungus (USFWS, 2015p).

Plants

One endangered and three threatened plant species are federally listed for Wyoming as summarized in Table 18.1.6-7. The Colorado butterfly Plant *(Gaura neomexicana var. coloradensis)* and Ute Ladies'-tresses *(Spiranthes diluvialis)* are found in the wet grasslands of central and eastern Wyoming (USFWS, 2015q) (USFWS, 2015r). The blowout penstemon *(Penstemon haydenii)* is specifically found in sandy soils of Carbon and Goshen counties (USFWS, 2015s). The desert yellowhead is a species found only on Beaver Rim of Fremont and Natrona counties, and the whitebark pine *(Pinus albicaulis)* is endemic to the mountainous portions of western Wyoming (USFWS, 2015t) (USFWS, 2015u). The whitebark pine (*Pinus albicaulis*) and Fremont County rockcress (*Boechera pusilla*) are candidate species known to occur in Wyoming (USFWS, 2016e). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Wyoming is provided below.

Table 18.1.6-7: Federally Listed Plant Species of Wyoming

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Wyoming	Habitat Description
Blowout Penstemon	*Penstemon haydenii*	E	No	Occurs in sparsely vegetated sandy blowouts in the early stages of plant community development in Carbon and Goshen counties, southeastern Wyoming.
Colorado Butterfly Plant	*Gaura neomexicana var. coloradensis*	T	Yes; in portions of two counties.	Occurs in stream channels and wetlands or among grasses of the high plains found in southeastern Wyoming.
Desert Yellowhead	*Yermo xanthocephalus*	T	Yes; in portions of two counties.	Occurs in aridic sandstone and limestone soils with high concentrations of volcanic ash derived from the Split Rock Formation near Riverton.
Ute Ladies'-tresses	*Spiranthes diluvialis*	T	No	Occurs in wetlands along rivers throughout central and eastern Wyoming.

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

Blowout Penstemon. The blowout penstemon is a perennial herb that grows between 1 to 2 feet in length and has tubular, two-lipped flowers that are a pale blue or purple in color (sometimes, although rarely, white or pink). The flowers are approximately one inch in length; flowers will produce fruit that will include approximately 30 seeds to germinate in the spring. This species was federally listed as endangered in 1987 (52 FR 32926 32929, September 1, 1987) (USFWS, 1992). Regionally, it is known or believed to occur in Nebraska and Wyoming. In Wyoming, it can be found in Carbon and Goshen counties in southeastern Wyoming (USFWS, 2015s).

Suitable habitat for this species includes sparsely vegetated sand blowouts located at the bases of mountains and ridges. The blowout penstemon is a primary invader as it is not a competitive species. Primary threats for this species include loss of habitat. (BLM, 2015a)

Colorado Butterfly Plant. The Colorado butterfly plant is a perennial flowering plant and member of the evening primrose family. The plant grows to approximately 2 feet tall and has white, ½ inch, four petal flowers and leaves of 2 to 6 inches in length. It was federally listed as threatened in 2000 (65 FR 62302 62310 October 18, 2000) and had specific critical habitat designated within Wyoming in 2004 (69 FR 47834 47862 August 6, 2004). The species occurs in southeastern Wyoming, northcentral Colorado, and western Nebraska. Within Wyoming the butterfly plant may be found in the lower southwestern portion of the state in Goshen, Laramie, and Platte Counties (USFWS, 2015q).

Although the historic range of the Colorado butterfly plant is unknown, the Colorado butterfly plant is typically found along stream channels and wetlands or among grasses of the high plains. "The most immediate and severe threat to the plant is the effect of residential and urban development. Haying and mowing at certain times of the year, water development, land conversion for cultivation, competition with exotic plants, non-selective use of herbicides are additional threats to the species” (USFWS, 2015q). The Colorado butterfly plant grows in open and disturbed areas historically maintained by flooding and fire. Grazing is an important component of maintaining disturbed grasslands and Colorado butterfly plant habitat (USFWS, 2015q).

Desert Yellowhead. The desert yellowhead is a tap-rooted, hairless perennial herb with leathery leaves and a leafy stem. This plant species is approximately 1 foot tall and contains between 25 to 180 yellow disk flowers. Once pollination occurs, each flower head produces a single-seeded fruit that disperses in the wind (USFWS, 2015t). The desert yellowhead was federally listed as threated in 2002 (67 FR 11442 11449, March 14, 2002). This species was designated with critical habitat in 2004 in Fremont county, central Wyoming (69 FR 3871 3872, January 27, 2004).

Suitable habitat for the desert yellowhead is limited to aridic sandstone and limestone soils with high concentrations of volcanic ash derived from the Split Rock Formation. Populations occur primarily along the Beaver Rim on barren low slopes or erosional fans below sandstone mesas. Primary threats to this species include small population size and the destruction or modification of habitat. (USFWS, 2010b)

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 Ute ladies’-tresses was federally listed as threatened in 1992 (57 FR 2048 205, January 17, 1992) and proposed to be delisted in 2004 (USFWS, 2015r). Though the species is recovering, its threatened status is current. The species occurs in Colorado, Idaho, Montana, Nebraska, Nevada, Utah, Washington, and Wyoming. In Wyoming, this species occurs within 22 counties across the entirety of the state (USFWS, 2015r).

Suitable habitat for this species includes wetlands, wet meadows, and swales 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 (USFWS, 1995).

18.1.7. Land Use, Recreation, and Airspace

18.1.7.1. Definition of the Resources

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

Land Use and Recreation

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

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

Airspace

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

The FAA operates a network of airport towers, air route traffic control centers, and flight service stations. The FAA also develops air traffic rules, assigns use of airspace, and controls air traffic in U.S. airspace. "The Air Traffic Organization (ATO) is the operational arm of the FAA responsible for providing safe and efficient air navigation services to approximately 30.2 million square miles of airspace. This represents more than 17 percent of the world's airspace and includes all of the 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 [FSDO], Regional Offices & Aeronautical Center, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (FAA, 2015c). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

18.1.7.2. *Specific Regulatory Considerations*

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

Because the Nation's airspace is governed by federal laws, there are no specific Wyoming state laws that would alter the existing conditions relating to airspace for this PEIS. Wyoming statutes (Title 10 Aeronautics) address airspace and flight safety at public airports and obstructions to airspace considerations (State of Wyoming, 2015d).

18.1.7.3. *Land Use and Ownership*

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

Land Use

Table 18.1.7-1 identifies the major land uses by coverage type in Wyoming. Shrub and grasslands comprise the largest portion of land use, with 80 percent of the land area in Wyoming occupied by this category. Forest and woodlands is the second largest area of land use with 13 percent of the total land area followed by agriculture with 4 percent of the total land area. Developed areas account for approximately one percent of the total land area in Wyoming. The remaining percentage of and includes public land, surface water, and other land covers, shown in Figure 18.1.7-1, that are not associated with specific land uses (USGS, 2012c).

Table 18.1.7-1: Major Land Uses in Wyoming by Coverage Type

Land Use	Square Miles*	Percent of Land
Shrub and Grassland	77,675	80%
Forest and Woodland	12,622	13%
Agricultural Land	3,884	4%
Public Land, Surface Water, and other Land Covers	1,942	2%
Developed Land	970	1%

Source: (USGS, 2012c)

*Square miles are rounded to the nearest whole number. The maps and tables are prepared from the analysis of GIS data and imagery; a margin of error may result 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. Other federal or state data sources may have slightly different totals.

Forest and Woodland

Forest and woodland areas can be found throughout the state, many of them interspersed with, and adjacent to, agricultural areas. The largest concentrations of forest are located in the western portion of the state within the Rocky Mountain geographic region (Figure 18.1.7-1). The large majority of forest and woodland areas throughout Wyoming are in federal ownership (over 90 percent), and approximately three percent of Wyoming's forests are managed by the Wyoming State Forestry Division (USFS, 2015j) (Wyoming State Forestry Division, 2015a). Section 18.1.6 presents additional information about terrestrial vegetation.

National Forests

National forests in Wyoming comprise approximately 75 percent of the state's total forestland, and includes 8 National Forests: Ashley, Bighorn, Black Hills, Bridger-Teton, Caribou-Targhee, Medicine Bow-Routt (and Thunder Basin National Grassland), Shoshone, and Wasatch-Cache National Forests. These National Forests occur primarily in the western portion of the state, covering 3.4 million acres (USFS, 2016a). The forests are managed for multiple uses and values, including recreation activities (e.g., camping, hiking), timber production, and maintenance of fish and wildlife habitat (USFS, 2016a).

State Forests

The Wyoming State Forestry Division manages approximately 411 square miles of forested state trust lands, which occur primarily on scattered parcels that are one square mile or smaller. These forestlands are managed for multiple-use purposes and values, including developed and undeveloped outdoor recreation (e.g., hiking, wildlife viewing), timber production, forest health, fish and wildlife habitat, hunting and fishing, and aesthetic preservation. Approximately 214 square miles of these forests are available for commercial timber harvest. Overall, these lands are managed to enhance their long-term value to the trust while producing revenue through sustainable timber harvest (Wyoming State Forestry Division, 2015a).

Private Forest and Woodland

A small percentage of Wyoming's total forestland is owned by private owners (Wyoming State Forestry Division, 2015a). Private forestlands indirectly provide some public benefit, including forest products, wildlife habitat, jobs, scenic beauty, and outdoor recreation opportunities. Scattered throughout the state, forests and woodlands on private lands often border agricultural fields, suburban neighborhoods, and state and national forests. For additional information regarding forest and woodland areas, see section 18.1.6, Biological Resources and Section 18.1.8, Visual Resources (USFS, 2015j) (Wyoming State Forestry Division, 2015a).

Agricultural Land

Agricultural land exists throughout the state on 3,884 square miles, or 4 percent of the total land area (Figure 18.1.7-1) (USGS, 2012d). Approximately 11,736 farms exist in Wyoming, with an average size of four square miles (USDA, Census of Agriculture, 2012a). Wyoming's top agricultural products are cattle and calves (65 percent of total agricultural receipts); other crops and hay (15 percent of total agricultural receipts); grains, oilseeds, beans, and peas (ten percent of total agricultural receipts); and sheep, goats, wool, mohair, and milk (three percent of total agricultural receipts) (USDA, Census of Agriculture, 2012b).

Developed Land

Developed land in Wyoming is concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 18.1.7-1). Although only 970 square miles, or one percent, of Wyoming land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 18.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates.

Table 18.1.7-2: Top Five Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Cheyenne, WY	63,335
Casper, WY	60,285
Gillette, WY	32,649
Laramie, WY	32,158
Rock Springs, WY	23,962
Total Estimated Population of Metropolitan Areas	**212,389**
Total State Estimated Population	**586,107**

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

Land Ownership

Land ownership within Wyoming has been classified into four main categories: private, federal, state, and tribal (Figure 18.1.7-2).[119]

[119] 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.

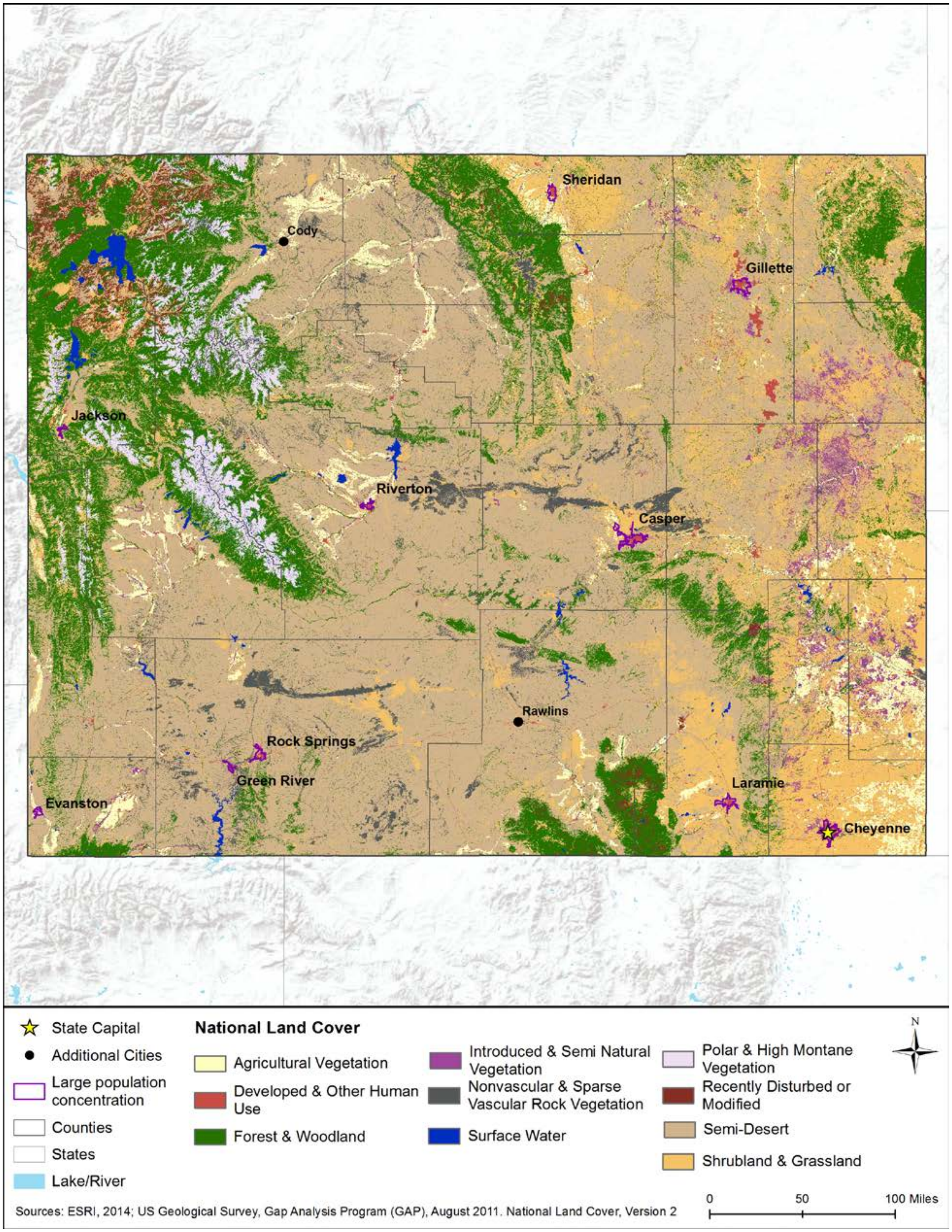


Figure 18.1.7-1: Major Land Use Distribution by Coverage Type

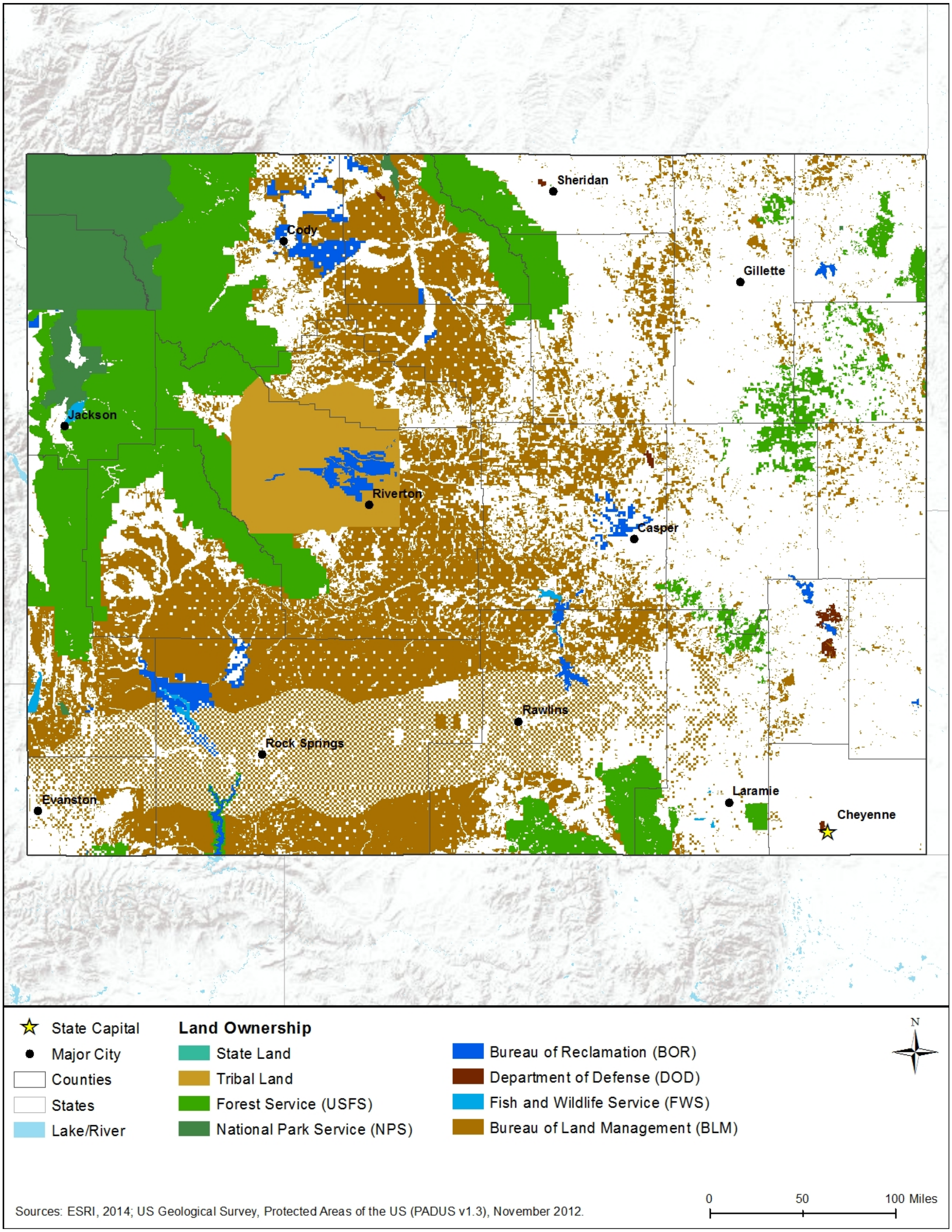


Figure 18.1.7-2: Land Ownership Distribution

Private Land

Approximately half of land in Wyoming is privately owned (Figure 18.1.7-2), with most of this land falling under the land use categories of agricultural, forest and woodland, and developed Figure 18.1.7-1). 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.[120]

Federal Land

The federal government manages 46,318 square miles, or approximately 47 percent, of land in Wyoming, including national forests, national wildlife refuges, and military facilities (Figure 18.1.7-2) (USGS, 2014i). Six federal agencies manage the majority of federal lands throughout the state (Table 18.1.7-3 and Figure Figure 18.1.7-2) (USGS, 2014e). There may be other federal lands, but they are not shown on the map due to their small size relative to the entire state.

Table 18.1.7-3: Federal Land in Wyoming

Agency	Square Miles	Representative Type
Bureau of Land Management (BLM)	26,874	Forests, Wilderness, Open Space
U.S. Department of Agriculture (USDA) Forest Service	14,085	National Forests, Grasslands
National Park Service (NPS)[a]	3,676	National Parks, Monuments, Historic Site, Recreation Area
Bureau of Reclamation	1,415	Lakes, Reservoirs, Grassland
Fish and Wildlife Service (USFWS)	159	Wildlife Refuges
Department of Defense (DoD)	109	Air Force Bases, Petroleum Reserve
Total	**46,318**	

Source: (USGS, 2014e)

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

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

- The BLM manages 26,874 square miles of open space comprised of forests, wilderness areas, shrublands/grasslands, and semi-desert areas (USGS, 2014e).
- The U.S. Department of Agriculture (USDA) Forest Service manages 14,085 square miles of land comprised of 8 National Forests: Ashley, Bighorn, Black Hills, Bridger-Teton, Caribou-Targhee, Medicine Bow-Routt (and Thunder Basin National Grassland), Shoshone, and Wasatch-Cache (USGS, 2014e).
- The National Park Service (NPS) manages 3,676 square miles of land comprised of 2 National Parks (Yellowstone and Grand Teton National Parks), 2 National Monuments (Fossil Butte and Devils Tower National Monuments), the Bighorn Canyon National Recreation Area, the Fort Laramie National Historic Site, 4 National Historic Trails, and a Memorial Parkway (USGS, 2014e).
- The Bureau of Reclamation manages 1,415 square miles of surface area comprised of 12 reservoirs (Buffalo Bill, Fontenelle, Eden, Flaming Gorge, Boysen, Pilot Butte, Alcova,

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

Pathfinder, Seminoe, Glendo, Keyhole, and Guernsey Reservoirs), three lakes (Jackson, Bull, and Ocean Lakes), and scattered land parcels (grasslands and semi-desert areas) (USGS, 2014e).

- The USFWS manages 159 square miles of land comprised of 7 NWRs in Wyoming (Cokeville, Seedskadee, Pathfinder, Mortenson Lake, Hutton Lake, National Elk Refuge, and Bamforth National Wildlife Refuges), and the Bear Valley Wetlands Study Area (USGS, 2014e).
- The DoD manages 109 square miles of land comprised of 3 military installations: Powell Air Force Station, Naval Petroleum Reserve, and Francis E. Warren Air Force Base (USGS, 2014e).

State Land[121]

Wyoming owns and manages approximately 6,214 square miles of land, or two percent of the total land in the state (Figure 18.1.7-2). These lands were granted to Wyoming in 1890 by the federal government and required to be held in trust and managed by the State Board of Land Commissioners and Office of State Lands and Investments to generate revenue to support public schools and other state institutions. In 1988, the State Board of Land Commissioners adopted rules allowing public use of the lands, including hunting, fishing, and general recreational use. Activities that would damage state lands are prohibited. If damage to or abuse of state lands occur, the State Board of Land Commissioners may temporarily or permanently close the damaged lands (Wyoming Office of State Lands and Investments, 2015).

Tribal Land

Approximately 3,522 square miles of land in Wyoming is managed by two American Indian tribes currently located in the state, across two reservations held in trust by the Bureau of Indian Affairs (Figure 18.1.7-2 and Table 18.1.7-4) (USGS, 2014e).[122]

Table 18.1.7-4: Indian Reservations in Wyoming

Indian Reservations	Square Miles
Wind River Reservation	3,521.5
Total	**3,521.5**

Source: (USGS, 2014e) (National Atlas, 2016)

18.1.7.4. Recreation

Wyoming's terrain consists of deserts, grasslands, plains, and plateaus broken up by numerous mountain ranges. This state has large expanses of wilderness, National Forests, and the iconic Yellowstone and Grand Teton National Parks. The Continental Divide crosses from the northwest corner of the state through the southcentral region, where it separates briefly around the arid Great Divide Basin. Major water features that provide a wide variety of recreational

[121] 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.
[122] Although the Bureau of Indian Affairs "manages" Native American lands, the Bureau of Indian Affairs is different than other land management agencies as the lands are held in trust and are sovereign nations.

opportunities include the Yellowstone, Bighorn, Wind, North Platte, Snake, and Green Rivers, and many mountain streams, lakes, and reservoirs. Casper and Cheyenne are Wyoming's largest cities. The rest of the state is sparsely populated, its residents living primarily in small ranching communities and towns or small cities that support nearby tourist destinations. Tourism is a major industry, especially in the western third of the state where the National Parks, Flaming Gorge National Recreational Area, forests, wilderness areas, and paleontological sites attract many visitors (Wyoming Tourism, 2016a).

On the community level, the larger cities and towns provide an assortment of indoor and outdoor recreational facilities including: community and recreation centers, theaters, museums, athletic fields and courts, golf courses, multi-use trails, playgrounds, picnicking areas, and boat launches. Availability of community-level facilities is typically commensurate to the population's distribution and interests, and the natural resources prominent in the vicinity. There are 11 state parks, one state recreation area, and one state petroglyph site (Legend Rock) (Wyoming State Parks, 2015a). Wyoming's history as a passageway around the central Rocky Mountains for American Indians, mountain men, miners, pioneers, emigrants, homesteaders, ranchers and farmers, has left hundreds of cultural/heritage sites and trails. Federally, the BLM, NPS, U.S. Forest Service (USFS), USFWS, and the U.S. Army Corps of Engineers (USACE) manage areas in Wyoming with substantial recreational attributes.

This section discusses key recreational opportunities and activities representative of various regions in Wyoming. The state can be categorized by five distinct recreational regions, each of which are presented in the following sub-sections (Wyoming Tourism, 2015a) (See Figure 18.1.7-3).[123] For information on visual resources such as National Scenic Byways and state-designated Byways, see Section 18.1.8, Visual Resources; and for information on culturally/ historically significant resources (e.g., National Historic Sites, National Historic Landmarks, sites on the National Register of Historic Places, and Natural Heritage Areas), see Section 18.1.11, Cultural Resources.

[123] 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 data set that contains large quantities of information relevant to the Proposed Action. The data was queried to show the Primary Designation Type of area. To show these in the map, recognizable symbols (e.g., varying shades of green for National Parks and Forests) were used as PAD-US does not have a standard symbolization for recreational resources. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

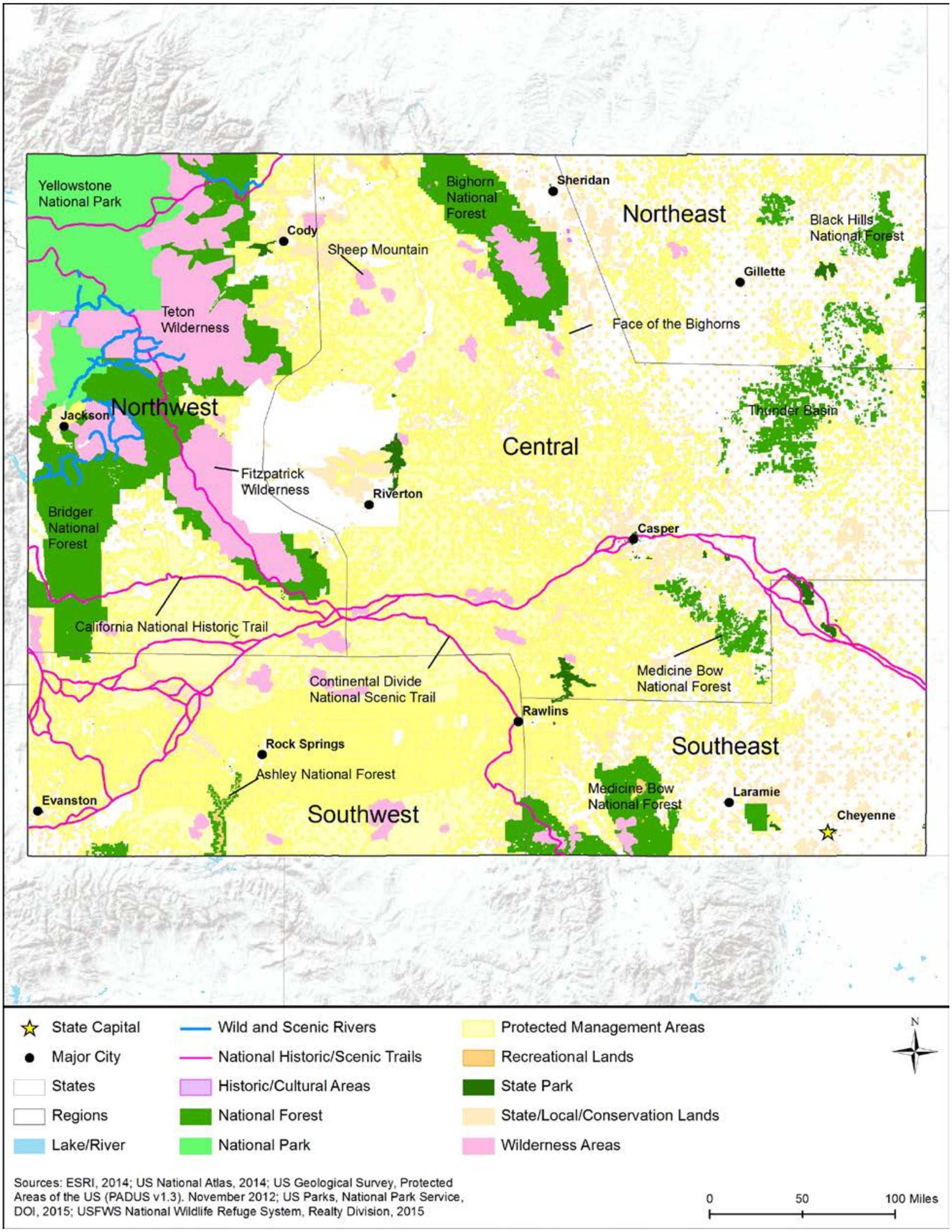


Figure 18.1.7-3: Wyoming Recreation Resources

Northeast Region

Wyoming's Northeast Region can be roughly defined as the area east of the Bighorn Mountains, north of the Thunderhead Basin National Grasslands, and bordered on the north by Montana, and on the east by South Dakota's Black Hills National Forest (Figure 18.1.7-3). Expansive grasslands, sagebrush plains, and rolling hills characterize this region's terrain. Devils Tower National Monument is a sacred American Indian site (Wyoming Tourism, 2015b). The nearby Belle Fourche River, Keyhole Reservoir, and Powder River are popular for fishing, boating, water sports, picnicking, camping, hiking, and bird watching. The Vore Buffalo Jump archaeological site and the Fort Phil Kearney State Historic Site are unique interpretive centers for visitors to explore. This region has numerous museums that feature western history and lore, especially as related to frontier military, pioneers, outlaws, and cowboys. These are primarily located near the region's largest cities, Gillette and Sheridan (Wyoming Tourism, 2015c). The city of Sheridan combines its rich authentic old west history with plenty of modern day culture. Historic downtown buildings like the Sheridan Inn, are complemented by new attractions like the Brinton Western and American Indian Art Museum. Several museums and historical sites are present in this area (Wyoming Tourism, 2015e).

Southeast Region

The Southeast Region is framed by the Laramie Mountains and the city of Casper to the north, Nebraska to the east, and the Medicine Bow Mountains, Continental Divide, and Great Divide Basin to the west. The capital, Cheyenne is just 100 miles north of the sprawling Denver, Colorado metropolis (Figure 18.1.7-3). Cheyenne's annual “Frontier Days” and Laramie's University of Wyoming bring many sporting and cultural events to the area. The nearby Vedauwoo granite formations allow rock climbing and mountain biking. (Wyoming Tourism, 2016a)

The Medicine Bow-Routt National Forests provide opportunities for camping, hiking, biking, horse and Off-Highway Vehicle (OHV) riding, fishing, hunting, water, and snow sports (USFS, 2015k). The Medicine Bow Mountains are also known as the Snowy Range, and the Snowy Range Scenic Byway is popular for sightseeing.

Central Region

The Central Region's city of Casper, the North Platte River, sagebrush plains, badlands, the Continental Divide encircling the Great Divide Basin, and the Big Horn Mountains are the significant landmarks of this region (Figure 18.1.7-3). Casper's historic downtown district, art galleries, National Historic Trails Interpretive Center, and Tate Geological Museum are popular tourist stops. Nearby outdoor recreational activities include golfing, hiking, biking, rock climbing, boating, watersports, skiing/snowboarding, and snowmobiling. The North Platte River is a favorite destination for anglers. To the west and north, are small towns that have cultural, historical, paleontological, and recreational treasures for visitors. Lander, located near the Wind River Range, and the Popo Agie and Bridger Wilderness Areas attracts adventurers wanting to explore these remote and pristine areas. Rock and ice climbers, hikers, campers, hunters, skiers, and snowmobilers regularly visit Ten Sleep Canyon. The Bighorn Mountains located adjacent to the Montana border on the north, are a rugged range with cultural, historical, and archaeological sites, and a wealth of recreational opportunities. Interesting historic sites near Guernsey include Register Cliff, where 19th century emigrants engraved their names in this limestone landmark as they made their way along the Oregon Trail, as well as the presence of visible Oregon Trail wagon wheel ruts, and the Fort Laramie National Historic Site (Wyoming Tourism, 2015d). Following the same general paths used by nomadic Indian tribes, trappers, miners, frontier military, and emigrating pioneers, the California/Oregon, Mormon, and Pony Express Trails passed through this region, leaving numerous historic and cultural sites, such as Fort Bridger and Old Mormon Ferry (BLM, 2010).

Northwest Region

The Northwest Region is dominated by rugged mountain ranges, national forests, wilderness areas, and the iconic Yellowstone and Grand Teton National Parks (Figure 18.1.7-3). Yellowstone is America's first National Park and in addition to preserving about half of the world's active geothermal geysers, it is a natural reserve that protects one of the last (and almost completely intact) temperate zone ecosystems in the world. Millions of visitors come each year to explore the natural wonders, wildlife, archaeological, and historic sites scattered throughout the more than two million acres of parkland (NPS, 2015b). Bordering to the south is the Grand Teton National Park, Bridger-Teton National Forest, the Wind River Range, and Teton, Gros Ventre, and Bridger Wilderness Areas. These natural areas add significant pristine landscape and recreational opportunities to this region's fantastic outdoor recreation corridor. Yellowstone and Jackson Lake, and the Yellowstone, North Fork, Snake, and Wind Rivers support opportunities for boating (canoeing, kayaking, rafting, and powerboating), water sports, fishing and wildlife viewing/photography. Snowmobiling, downhill and cross-country skiing, snowboarding, snowshoeing, ice fishing, and ice climbing are popular throughout this region in the wintertime. Horseback and all-terrain vehicle (ATV) riding, biking, camping, hiking, backpacking, rock climbing, and hunting are common activities pursued in the milder months. Jackson Hole has well-respected art galleries and performing arts venues, as well as golf, tennis, hot air ballooning, hang gliding, ski resorts, and the National Elk Refuge (Wyoming Tourism, 2015f). To the east is Cody, with attractions and museums that center on the lore of its namesake Buffalo Bill Cody, and Powell with its history as a World War II internment center for Americans of Japanese descent. (Wyoming Tourism, 2015g)–The Great Divide Basin and Continental Divide were monumental obstacles for emigrants in their journeys, and numerous historical monuments mark key sites where they traveled including: Independence Rock and South Pass City. Within the more than 2-million acre Wind River Indian Reservation (U.S. Department of the Interior, 2015a), Riverton draws visitors to its Mountain Man Rendezvous, Hot Air Balloon Rally, and the water-based recreation opportunities supported by the surrounding rivers and reservoirs. Thermopolis is well known for its impressive hot springs, Hot Springs State Park, Wyoming Dinosaur Center, and Legend Rock Petroglyph site (Wyoming Tourism, 2016b). The Bighorn Canyon National Recreation Area and Big Horn National Forests are heavily visited by boaters, hikers, bikers, skiers, campers, fishermen, and hunters.

Southwest Region

The Southwest Region has rich paleontological and historical sites for visitors to explore. The terrain is primarily high sagebrush desert plains, with the Great Divide Basin to the east and Utah's Uinta Mountains to the south. Flaming Gorge National Recreation Area is the most prominent natural feature in this region (the majority of it lies in Wyoming, but a portion of it extends into Utah) (Figure 18.1.7-3). The Gorge's 91-mile reservoir has over 300 miles of shoreline, and over 96,000 acres of National Forest surrounding it in the Wyoming portion. Marinas, boat ramps, resorts, campgrounds, and picnic areas are available for those engaging in water sports, fishing, and sightseeing. Multi-use trails for hiking, biking, horseback riding, snowmobiling, and cross-country skiing are other popular recreational pursuits. (Wyoming Tourism, 2015h)

A portion of the world's largest known deposit of freshwater fish fossils (reptile, bird, insect, plant, and mammal fossils are also present) are displayed at Fossil Butte National Monument (NPS, 2015c). This region also has five of Wyoming's largest Wild Horse Management Areas, visited by individuals seeking to adopt a horse (BLM, 2015b). Those just wanting to see or photograph the horses, native wildlife, and scenery can drive the Pilot Butte Wild Horse Scenic Loop (Wyoming Tourism, 2015i).

Rock Springs, the largest city in this region, has a well-known Community Fine Arts Center and a Historical Museum. The Killpecker Sand Dunes just north of town, are popular with OHV riders, and hikers, and Boar's Tusk attracts rock climbers. (Wyoming Tourism, 2015j)

18.1.7.5. Airspace

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

Airspace Categories

There are two categories of airspace or airspace areas:

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

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 18.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[124] service is based on the airspace classification (FAA, 2008).

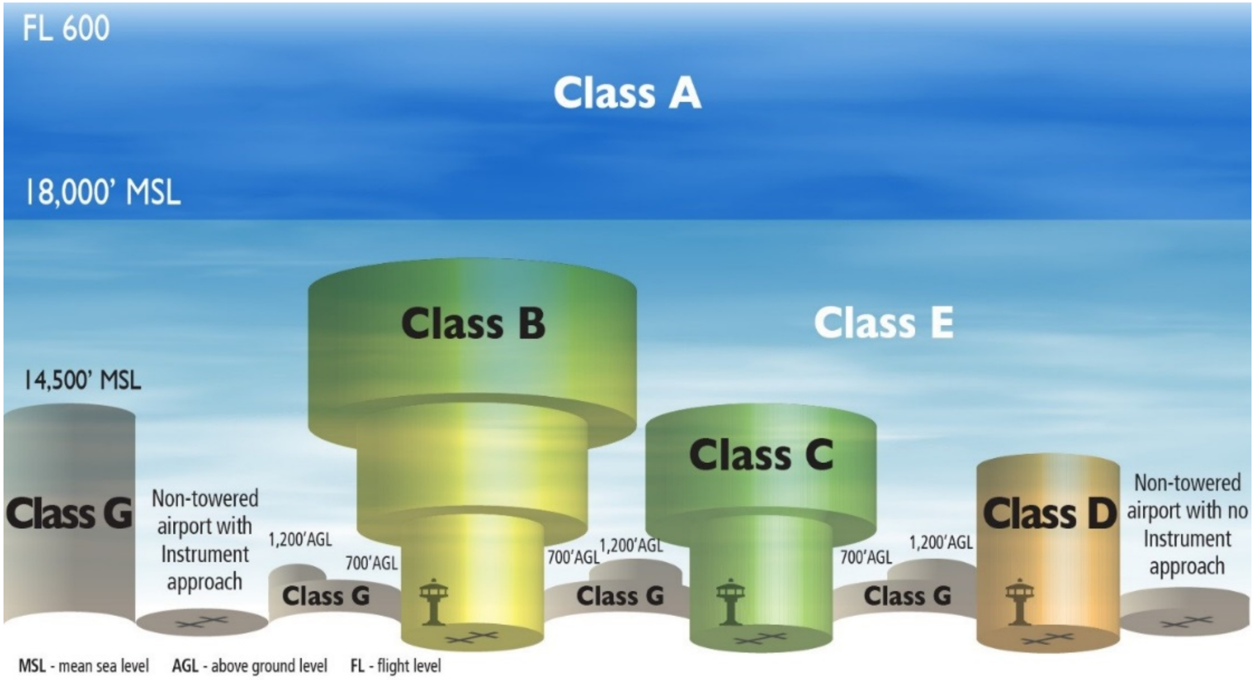


Figure 18.1.7-4: National Air Space Classification Profile

Source: Derived from (FAA, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[125]. 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).[126]
- **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.

[124] ATC – Approved authority service to provide safe, orderly and expeditious flow of air traffic operations. (FAA, 2015d)
[125] MSL – The average level of for the surface of the ocean; "The height of the surface of the sea midway between the average high and low tides." (FAA, 2015d)
[126] IFR – Rules for the conduct of flights under instrument meteorological conditions (FAA, 2015d).

- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.
- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2008).

Uncontrolled Airspace

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

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (See Table 18.1.7-5).

Table 18.1.7-5: SUA Designations

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

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

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

Other Airspace Areas

Other airspace areas, explained in Table 18.1.7-6, include Airport Advisory, Military Training Routes (MTR), Temporary Flight Restrictions (TFR), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 18.1.7-6: Other Airspace Designations

Type	Definition
Airport Advisory	There are three types: • Local Airport Advisory – Operated within 10 statute miles (5,280 feet/mile) of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. • Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. • Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: • Protect people and property from a hazard; • Provide safety for disaster relief aircraft during operations; • Avoid unsafe aircraft congestion associated with an incident or public interest event; • Protect the U.S. President, Vice President, and other public figures; • Provide safety for space operations; and • Protect in the State of Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of "permanent" are included in this Draft PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.
Published VFRs and IRs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

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

18.1.7.6. Aerial System Considerations

Unmanned Aerial Systems

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

UAS at airports is a complex operational challenge with the need to separate UAS flight operations from mainstream air traffic. Separation can be achieved with specific UAS launch windows, special airports, or off-airport locations that allow the UAS to easily launch and recover. Special aviation procedures are applied to UAS flights. There must be the capability of Sense and Avoid (SAA) and Control and Communication (C2) during UAS operations. An Unmanned Aircraft (UA) must be able to see (or sense) other aircraft in the area and avoid the aircraft through corrected flight path changes. General equipment and operational requirements can include aircraft anti-collision lights, an altitude encoding transponder, cameras, sensors, and collision avoidance maneuvers. The C2 of the UA occurs with the pilot/operator, the UAS control station, and ATC. Research efforts, a component of the FAA's UAS roadmap, continue to mature the technology for both SAA and C2 capabilities.

Balloons

Moored balloons and unmanned free balloons cannot be operated in a prohibited or restricted area unless approval is obtained from the controlling agency. Balloons also cannot be operated if they pose a hazard to people or their property.

18.1.7.7. Obstructions to Airspace Considerations

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

- "Any construction or alteration exceeding 200 ft aboveground level
- Any construction or alteration:

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

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

18.1.7.8. Wyoming Airspace

The Wyoming Aeronautics Division is under the jurisdiction of the Wyoming Department of Transportation. The Division promotes aviation safety and air service for the state via three sections – Air Services Development, Engineering and Construction, and Flight Operations/Chief Pilot (WYDOT, 2015b). Working with public and private entities, the Wyoming Aeronautics Commission assists with maintaining a safe aviation system (WYDOT, 2015c). There is no FAA FSDO for Wyoming, however, there is a FAA Flight Standards Field Office located in Casper, which is a component of the Denver, Colorado FSDO (FAA, 2015f).

Wyoming 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 18.1.7-5 presents the different aviation airports/facilities in Wyoming, while Figure 18.1.7-6 and Figure 18.1.7-7 present the breakout by public and private airports/facilities. There are 120 airports within Wyoming as presented in Table 18.1.7-7 and Figure 18.1.7-5 through Figure 18.1.7-7 (USDOT, 2015).

Table 18.1.7-7: Type and Number of Wyoming Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	41	54
Heliport	0	25
Seaplane	0	0
Ultralight	0	0
Balloonport	0	0
Gliderport	0	0
Total	**41**	**79**

Source: (USDOT, 2015)

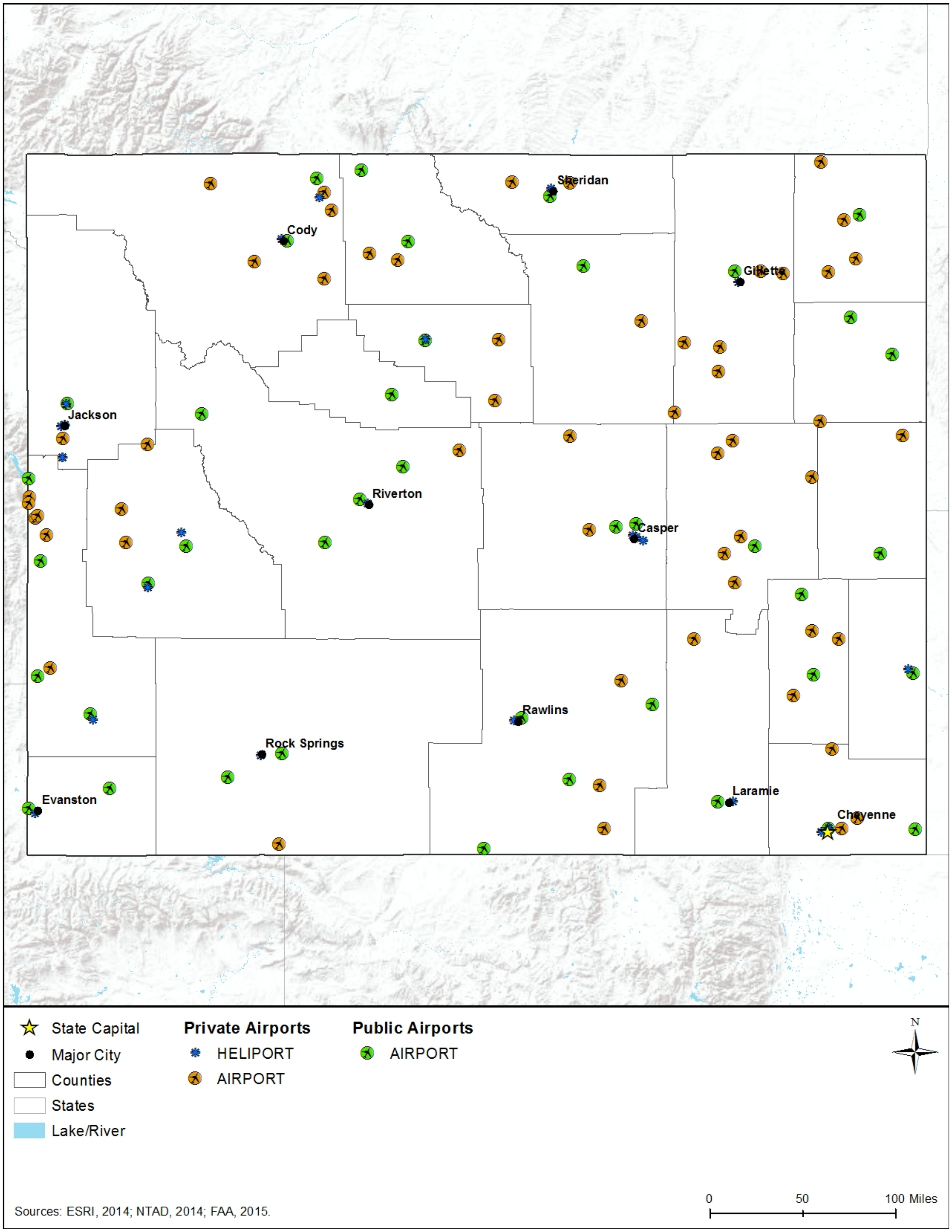


Figure 18.1.7-5: Wyoming Public and Private Airports/Facilities

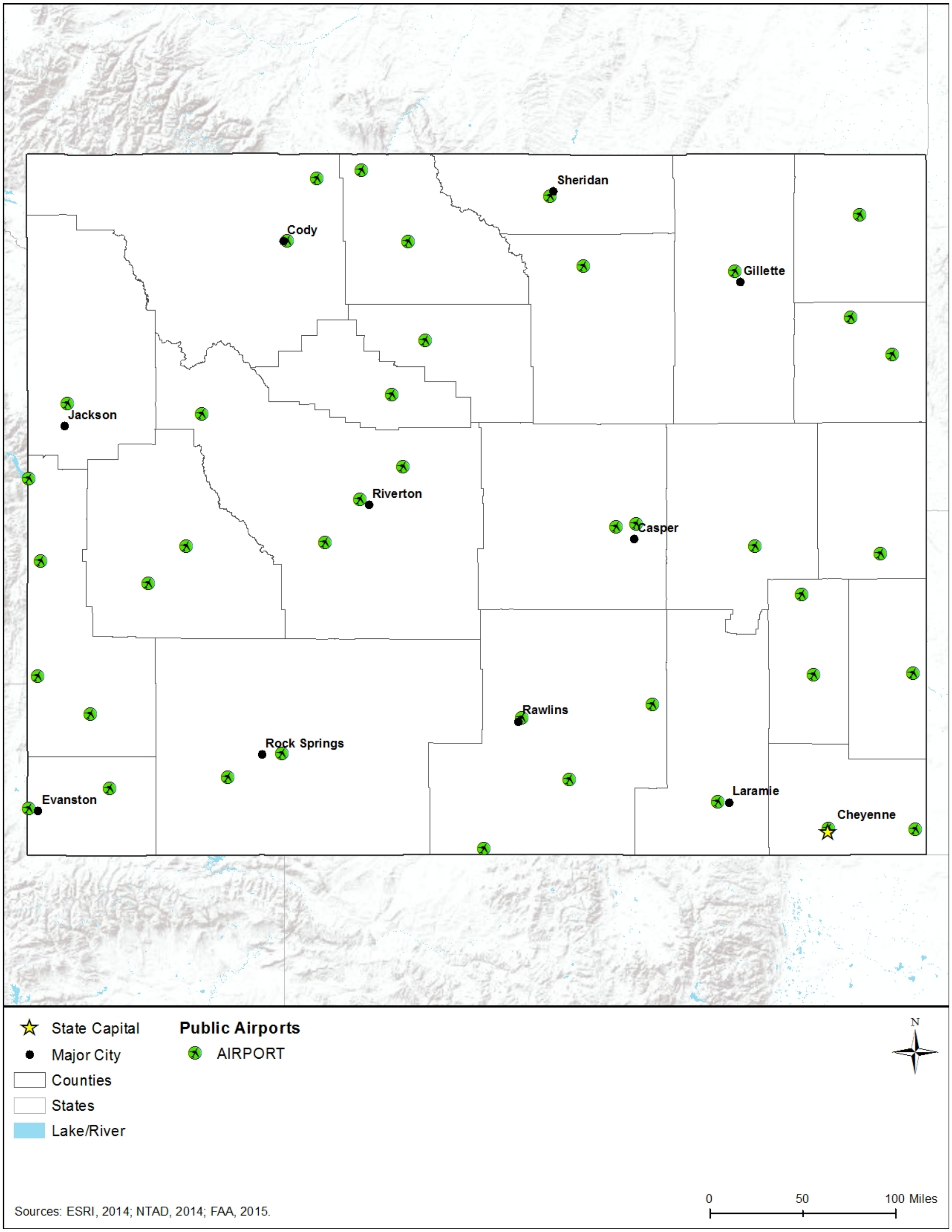


Figure 18.1.7-6: Public Wyoming Airports/Facilities

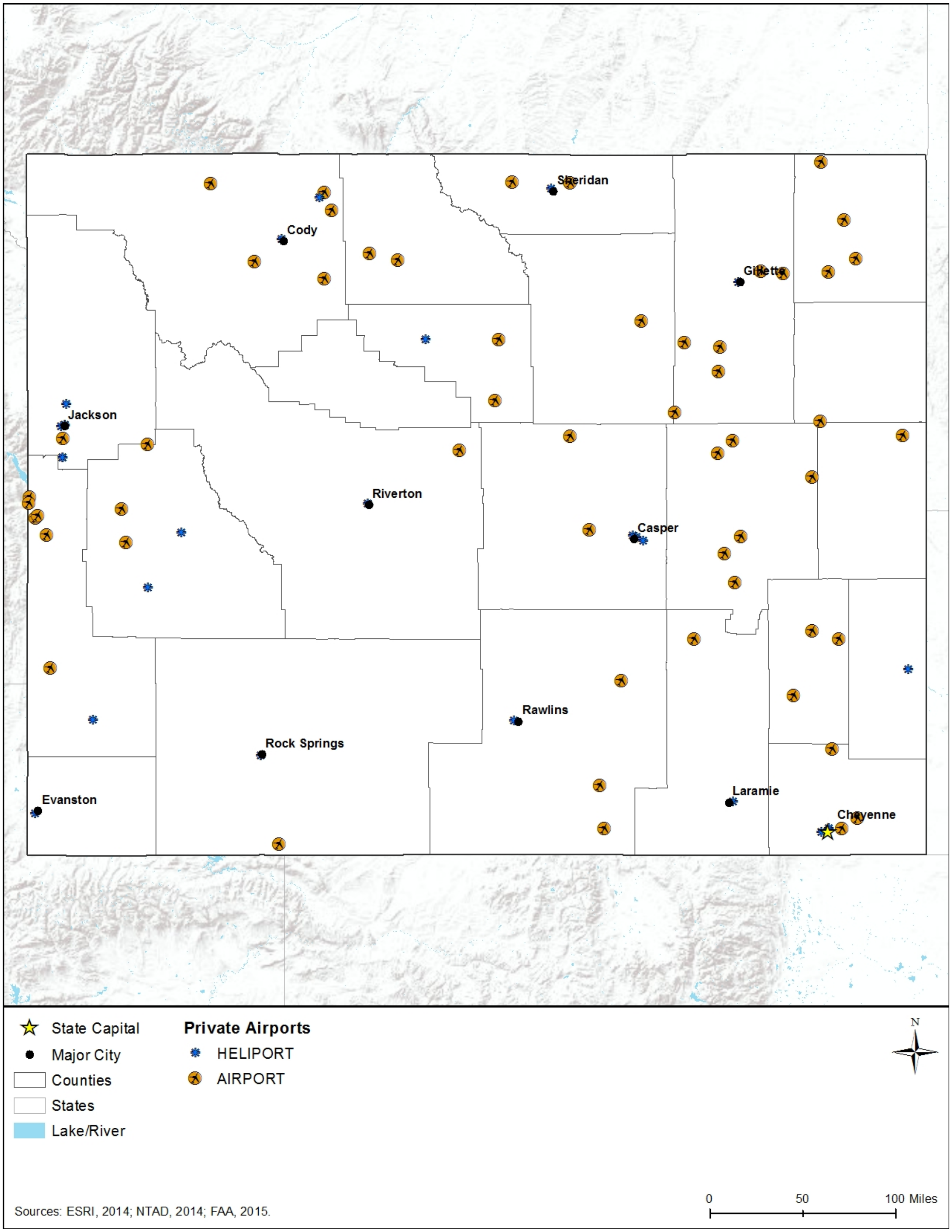


Figure 18.1.7-7: Private Wyoming Airports/Facilities

There are no Class B or C airports in Wyoming. Class D controlled airports for Wyoming are as follows:

- Five Class D –
  - Camp Guernsey, Guernsey
  - Natrona County International, Casper
  - Cheyenne, Cheyenne
  - Gillette-Campbell County, Gillette
  - Jackson Hole, Jackson (FAA, 2015g)

SUAs (i.e., three restricted areas and one MOA) located in Wyoming are as follows:

- Guernsey –
  - R-7001A – Surface to, but not including, 8,000 feet MSL
  - R-7001B – 8,000 feet MSL to 23,500 feet MSL
  - R-7001C – 23,500 feet MSL to 30,000 feet MSL

The one MOA located in Wyoming is as follows:

  - Powder River B – 1,000 feet Above Ground Level (AGL) to, but not including, Flight Level 180; Except 1,500 feet AGL within a three NM radius of Lanning Ranch Airport, MT (FAA, 2016)

The SUAs for Wyoming are presented in Figure 18.1.7-8. There are no TFRs (See Figure 18.1.7-8) (FAA, 2015h). MTRs in Wyoming, presented in Figure 18.1.7-9, consist of five Instrument Routes.

UAS Considerations

The National Park Service (NPS) signed a policy memorandum on June 24, 2014 that “directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service” (NPS, 2014c). There are seven national parks in Wyoming that have to comply with this agency directive (NPS, 2015d).

Obstructions to Airspace Considerations

Several references in Wyoming statues address airspace hazards. Wyoming Statutes, Title 10, Chapter 4 – 305, addresses structures, as they obtain to potential impacts to navigable airspace. This chapter is to “harmonize, as far as possible, with federal laws and regulations on the subject of aeronautics” (State of Wyoming, 2015d).

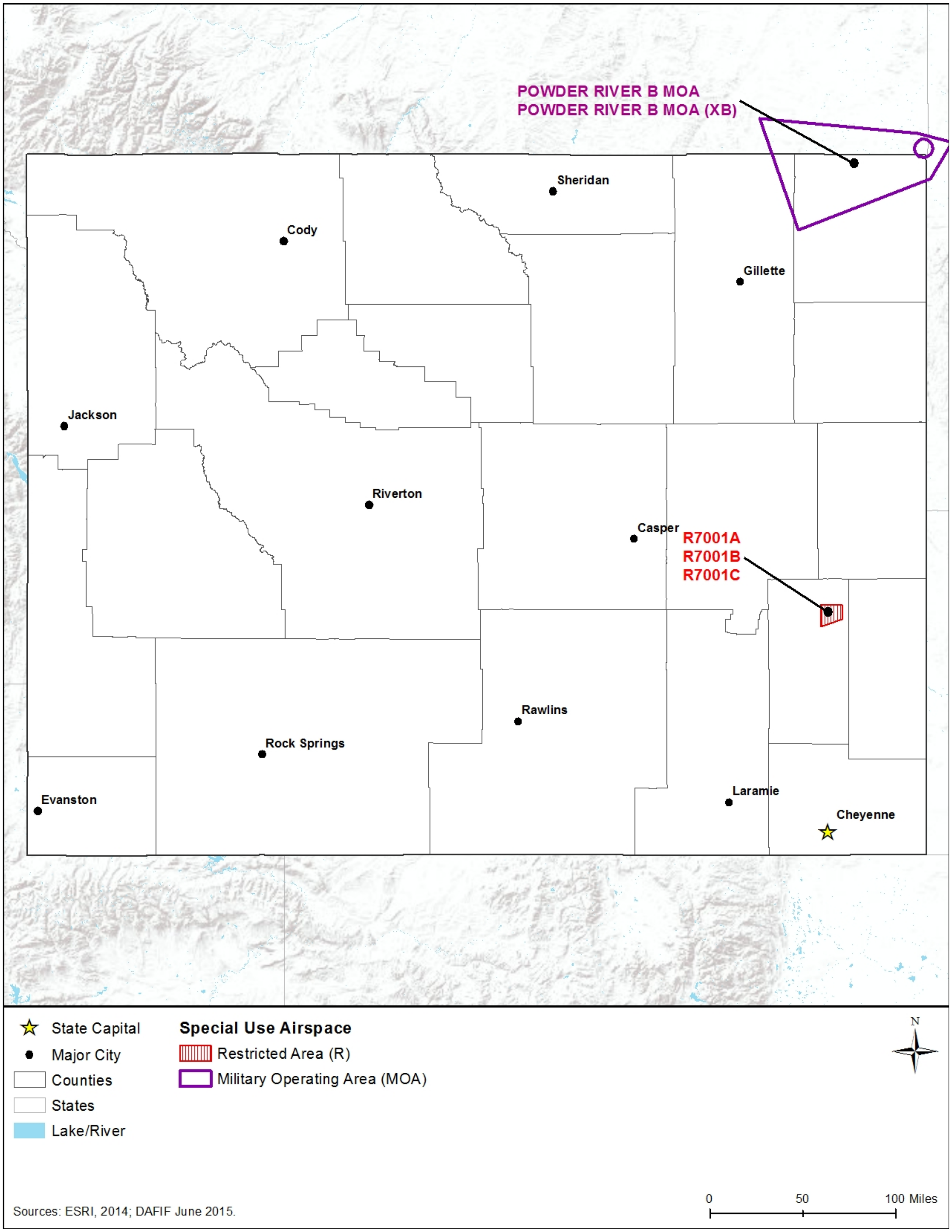


Figure 18.1.7-8: SUAs in Wyoming

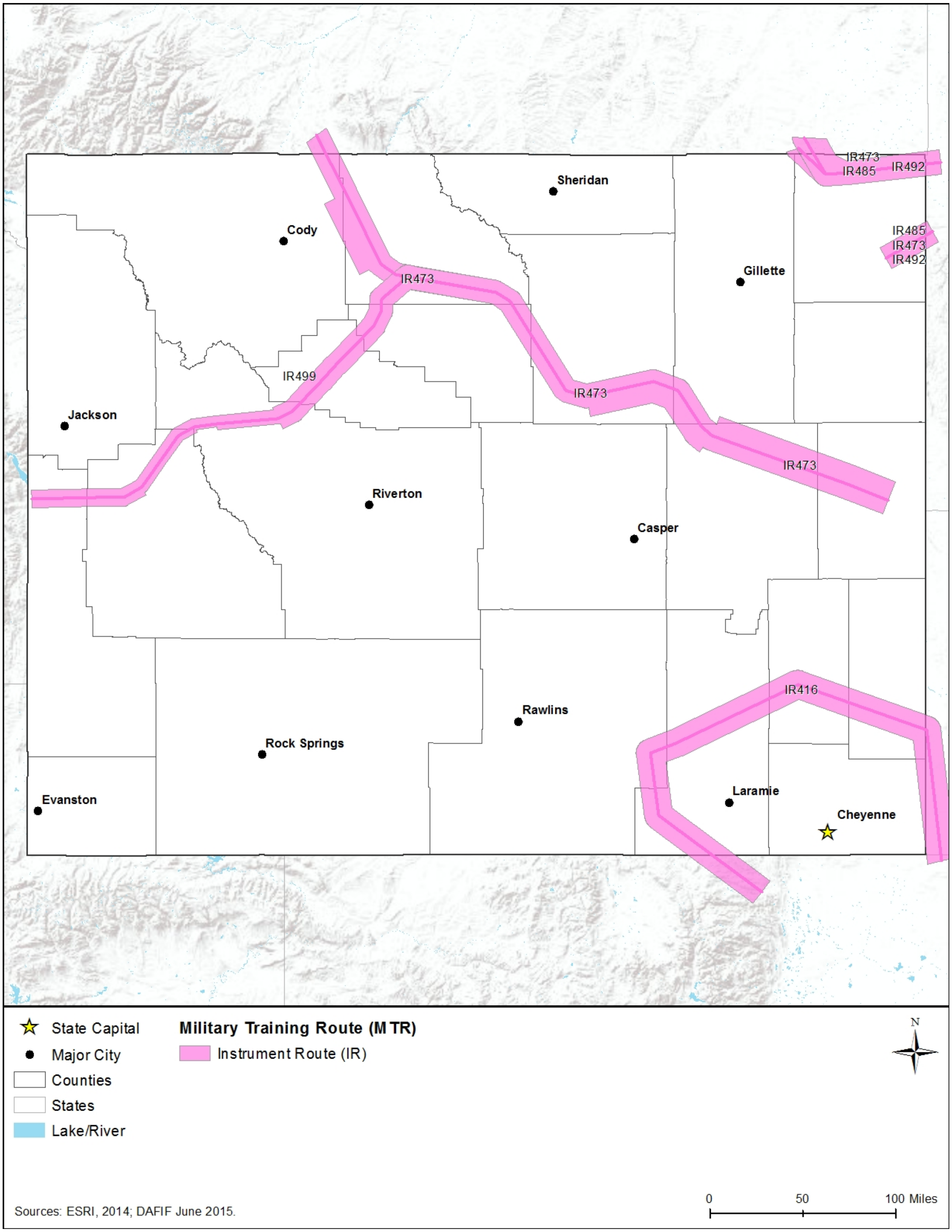


Figure 18.1.7-9: MTRs in Wyoming

18.1.8. Visual Resources

18.1.8.1. Definition of the Resource

Visual resources influence the human experience of a landscape. Various aspects combine to create visual resources, such as color, contrast, texture, line, and form. Features (e.g., mountain ranges, city skylines, ocean views, unique geological formations, rivers) and constructed landmarks (e.g., bridges, memorials, cultural resources, or statues) are considered visual resources. For some, cityscapes are valued visual resources, whereas others prefer natural areas. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for NEPA and 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 Bureau of Land Management, "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)" (BLM, 1984).

18.1.8.2. Specific Regulatory Considerations

Table 18.1.8-1 presents state and local laws and regulations that relate to visual resources for Wyoming.

Table 18.1.8-1: Relevant Wyoming Visual Resources State Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Senate File SF0017, Outdoor Lighting. Wyoming Statute (W.S.) 35-11-1601 through 35-11-1603, W.S. 15-1-103(a), and 18-2-101(a)	Wyoming Counties	To "adopt ordinances regulating the types, kinds, construction, installation and uses of outdoor electrically powered illuminating devices, lighting practices and systems in order to reduce light pollution and light trespass" (State of Wyoming, 1999).
State Land Use Planning Act W.S. 9-8-101 through 9-8-302, as amended.	Local Governments	"All local governments shall develop a local land use plan within their jurisdiction" (Justia Law, 2015).
Wyoming State Statutes 18-5-202	Local Governments	"The planning and zoning commission may prepare and amend a comprehensive plan including zoning for promoting the public health, safety, morals, and general welfare of the unincorporated areas of the county and certify the plan to the board of county commissioners" (State of Wyoming, 2011).
Comprehensive Statewide Historic Preservation Plan	Wyoming State Historic Preservation Office	The plan "guides the actions and sets the priorities for historic preservation activity in Wyoming" (Wyoming State Parks, 2007).

In addition to the state laws and regulations, local zoning laws may relate to visual resources. Viewsheds and scenic vistas are increasingly important to the states, towns, and cities, as they look at the future planning of their municipalities.

Wyoming's State Land Use Planning Act requires the 23 counties within the state to have a comprehensive plan, some of which include management of visual resources regarding utility and wind towers, historic areas, and other scenic areas (University of Wyoming, Undated).

18.1.8.3. Character and Visual Quality of the Existing Landscape

Wyoming terrain includes the Great Plains, Intermontane Basins, and the towering peaks of the Rocky Mountains. While much of the state is low, rolling hills or flatlands with prairie grasses and sagebrush (about 75 percent of the state), the state also boasts some of the most picturesque mountain ranges in the country within the Grand Teton and Wind River mountain ranges, among a dozen of ranges throughout the state. The state is ranked 50th in population and 10th in size. The mountain ranges in the northwestern portion of the state contain most of the state's forested lands, has the highest mountain peaks, and is generally considered to showcase the most scenic landscapes in Wyoming with both Grand Teton National Park and Yellowstone National Park. The open landscapes in southern and eastern Wyoming allow for miles and miles of uninterrupted vistas. Towns are few and far between, and the populated areas have been maintained to continue the historic character of the main streets and surrounding ranching or mining communities. (USGS, 2012e) (NPS, 2016a) (NPS, 2016b)

One aspect of visual resources that can be important is maintaining the character of the area. For example, in a farm community, keeping the character of the town consistent with farm-style houses, barns, and silos could be key in maintaining the character of the community. In a more metropolitan area, there may be many different visual styles within each neighborhood, but keeping the character of the neighborhood might be important to maintain if a new development were to occur. Section 18.1.10 discusses land use and contains further descriptions of land cover within the state.

Wyoming has considered the management and protection of scenic resources in many of their land use and planning policies (Table 18.1.8-1). While the state and many municipalities have some regulation of scenic and visual resources, not all scenic areas within the state have been identified or have policy or regulations for management or protection by the state. The areas listed below have some measure of management, significance, or protection through state or federal policy, as well as being identified as a visually significant area.

18.1.8.4. Visually Important Historic Properties and Cultural Resources

Visual and aesthetic qualities of historic properties can contribute to the overall importance of a particular site. Such qualities relate to the integrity of the appearance and setting of these properties or resources. Viewsheds (the natural and manmade environment visible from one or more viewing points) can also contribute to the significance of historic properties or cultural resources (NASA, 2013). Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 18.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Wyoming, there are 538 NRHP listed sites, which include 25 National Historic Landmarks, 1 National Historic Site, and 2 National Monuments. Some State Historic Sites, State Heritage Areas, and State Historic Districts may also be included in the NRHP, whereas others are not designated at this time.

The *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).

World Heritage Sites

Sites are designated World Heritage sites if they reflect "the world's cultural and natural diversity of outstanding universal value" (UNESCO, 2015a). To be included on the World Heritage List, sites must meet 1 of 10 criteria reflecting cultural, natural, or artistic significance (UNESCO, 2015b). World Heritage sites are diverse and range from archaeological remains, national parks, islands, buildings, city centers, and cities. The importance of World Heritage-designated properties can be attributed to cultural or natural qualities that may be considered visual resources or are visually sensitive at these sites. In Wyoming, Yellowstone National Park is a designated natural World Heritage site (Figure 18.1.8-1) (UNESCO, 2016). More information on this and other National Parks is presented in Section 18.1.8.5.

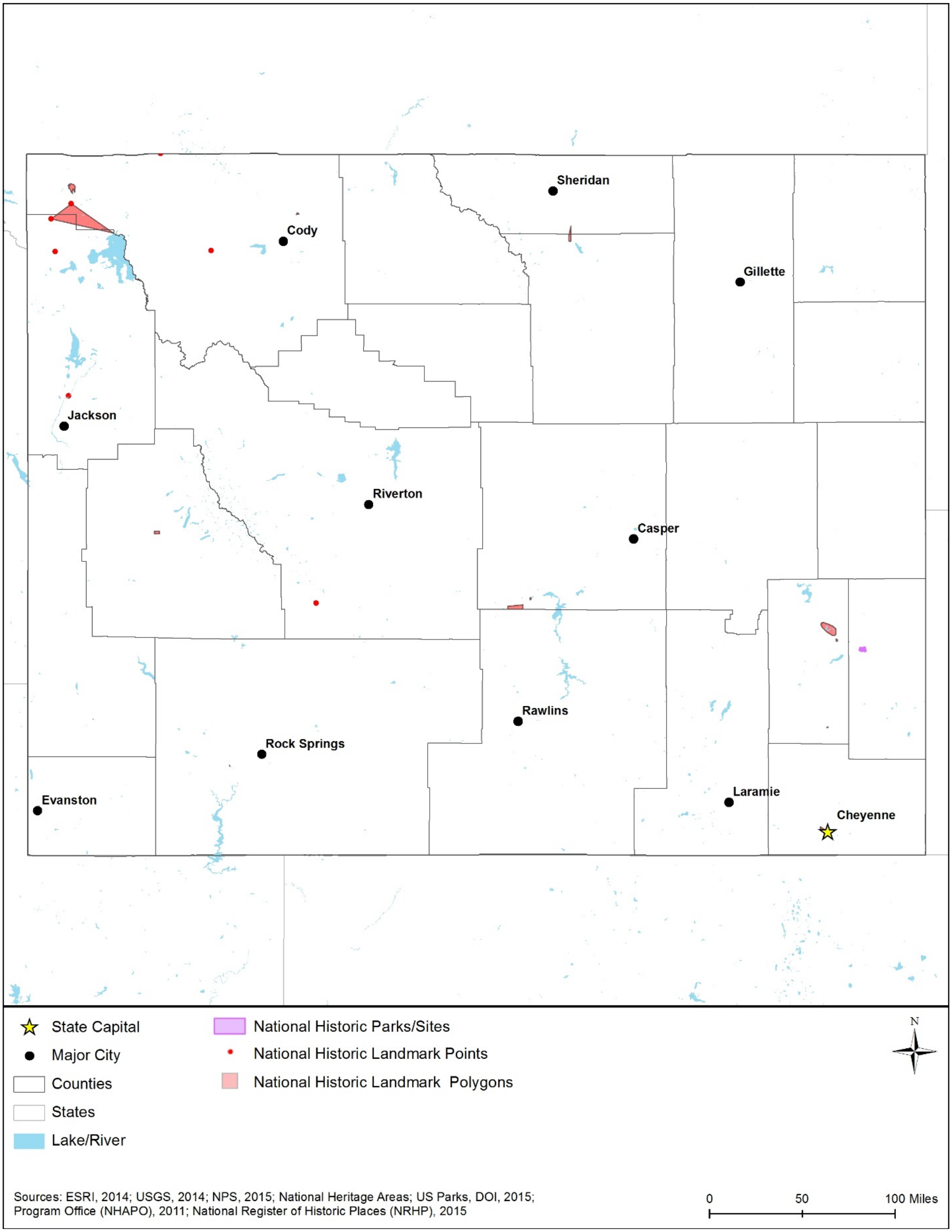


Figure 18.1.8-1: Representative Sample of Cultural and Heritage Resources that May be Visually Sensitive

National Historic Landmarks

National Historic Landmarks (NHL) are defined as "nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States" (NPS, 2015e). NHLs may include "historic buildings, sites, structures, objects, and districts" (NPS, 2016c). Other types of historic properties include forts, American Indian historic sacred sites, and travel routes. 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. There are 25 NHLs in Wyoming which include a variety of historic structures but also include historic stopovers along travel routes and natural areas. By comparison, there are over 2,500 NHLs in the United States (NPS 2015b). Figure 18.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive. The scenic and visual resources of these landmarks and surrounding areas are managed for consistency with the historic resource and aesthetics of the landscape. The following sites have been designated as NHLs in Wyoming:

- Expedition Island
- Fort D.A. Russell
- Fort Phil Kearny and Associated Sites
- Fort Yellowstone
- Heart Mountain Relocation Center
- Horner Site
- Independence Rock
- Jackson Lake Lodge
- Lake Guernsey State Park
- Lake Hotel
- Medicine Mountain
- Murie Ranch Historic District
- Norris, Madison, and Fishing Bridge Museums
- Obsidian Cliff
- Old Faithful Inn
- Oregon Trail Ruts
- J.C. Penney Historic District
- Sheridan Inn
- South Pass
- Tom Sun Ranch
- Swan Land and Cattle Company Headquarters
- Union Pacific Railroad Depot
- Upper Green River Rendezvous Site
- Wapiti Ranger Station
- Wyoming State Capitol

(NPS, 2015f)

National Historic Sites

There is one National Historic Site in Wyoming, Fort Laramie. The site is 833 acres in the river valley and grasslands of southeastern Wyoming near the confluence of the Laramie and North Platte Rivers (NPS, 2015g).

National Historic Trails

Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Trails are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass" (NPS, 2009).

There are 4 National Historic Trails in Wyoming. The California, Mormon Pioneer, Oregon, and Pony Express National Historic Trails follow the North Platte River from Nebraska and continue across the entire state of Wyoming. The scenic resources along the trails may be protected within the various agencies' jurisdictions. These trails trace the pathway of historic travelers across the west, including trail ruts, other historic sites, and structures. Visual resources along the trail include historic buildings, geologic features, mountain peaks, river valleys, forests, and grasslands. (NPS, 2015h)

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, 2015a).

State Historic Sites

There are 18 State Historic Sites throughout Wyoming. Most of these site have historic structures or historic features from travelers heading west. The landscapes surrounding these sites contain river vistas, geologic features, manicured gardens, rugged mountains, rolling hills, forests, and grasslands.

- Ames Monument Historic Site
- Camp Douglas Officers' Club State Historic Site
- Connor Battlefield Historic Site
- Fort Bridger Historic Site
- Fort Fetterman Historic Site
- Fort Fred Steele Historic Site
- Fort Phil Kearny Historic Site
- Granger Stage Station Historic Site
- Historic Governor's Mansion
- Independence Rock Historic Site
- Medicine Lodge Archaeological Site
- Names Hill Historical Site
- Oregon Trail Ruts
- Piedmont Charcoal Kilns Historic Site
- South Pass City Historic Site
- Trail End Historic Site

(Wyoming State Parks, 2015b)

18.1.8.5. Parks and Recreation Areas

Parks and recreation areas include state parks, National Recreation Areas, 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 18.1.7-1 in Section 18.1.7, Land Use, Recreation, and Airspace identifies parks and recreational resources that may be visually sensitive in Wyoming. For additional information about recreation areas, including national and state parks, see Section 18.1.7, Land Use, Recreation, and Airspace.

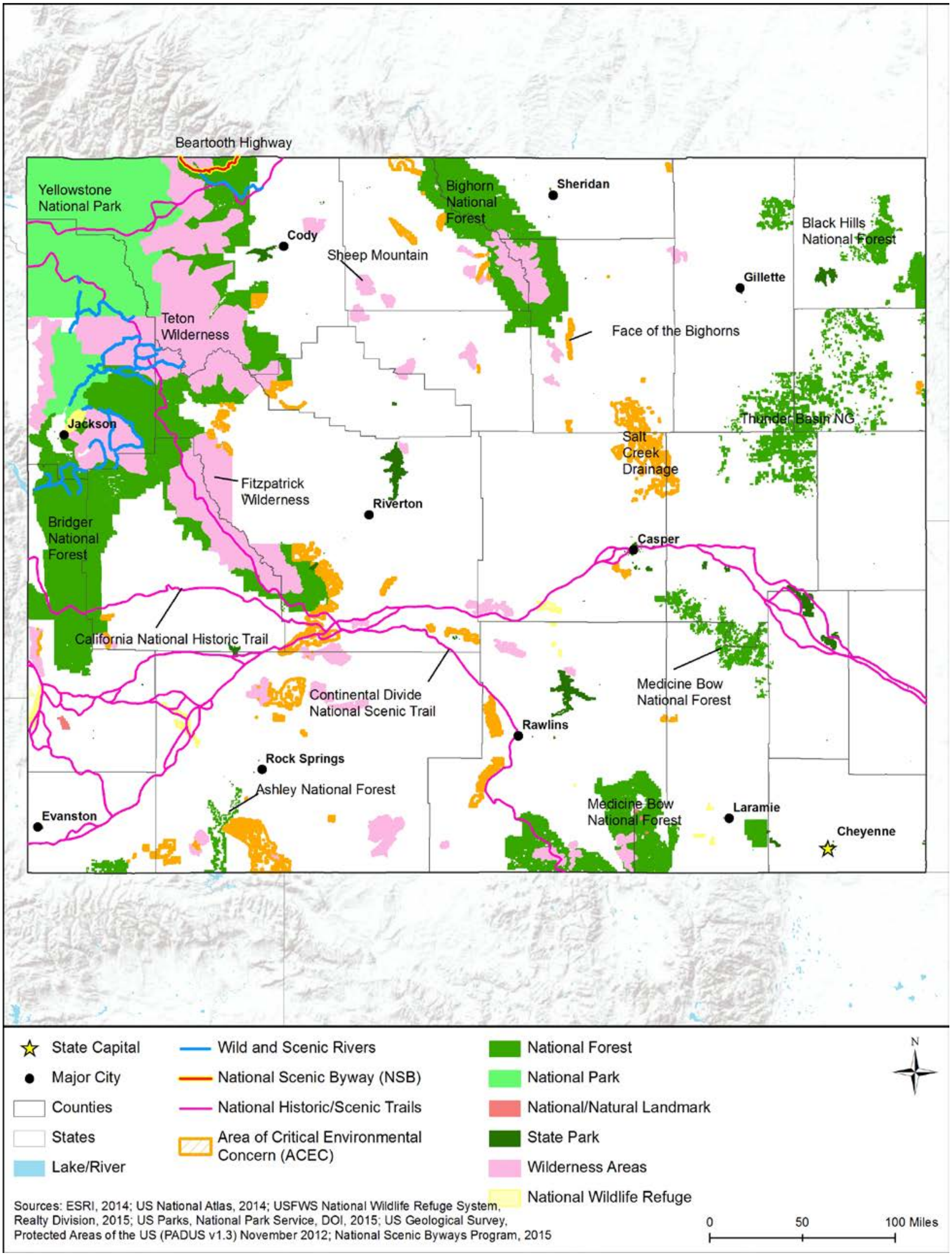


Figure 18.1.8-2: Natural Areas that May be Visually Sensitive

National Park Service

National Parks are managed by the NPS and contain natural, historic, cultural, visual, ecological, and recreation resources of significance to the nation and are maintained for the public's use. In Wyoming, there are seven[127] officially designated National Parks in addition to other NPS affiliated areas, such as National Heritage Areas. There are 1 National Recreation Area, and 2 National Monuments, 4 National Historic Trails, 1 National Historic Site, 2 National Parks, and 1 Memorial Parkway in Wyoming (See Figure 18.1.8-2).[128] The scenic resources of Yellowstone and Grand Teton National Parks are world-renowned. As identified in Section 18.1.8.3, Yellowstone National Park is a designated natural World Heritage Site and is considered a natural treasure with universal value (UNESCO, 2016). The 2.2 million acre park spans into Idaho and Montana, with the majority of the park within northwestern Wyoming. The variety of dramatic scenery within the park is breathtaking. Majestic waterfalls, steep canyons, jagged peaks, pristine valleys, geysers, hot springs, rivers, and sparkling lakes are all part of this globally recognized park. The landscape is also designated as a federal wilderness area, which further maintains the pristine visual and scenic resources of the park (NPS, 1972).

Grand Teton National Park is true to its name (Figure 18.1.8-3). With grand vistas of the towering Teton Range, this 305,504 acre park has captivating landscapes of the majestic glacial peaks, alpine forests and lakes, lush meadows, winding rivers, and wide vistas from lookouts atop the mountains. (NPS, 2015i)

Figure 18.1.8-3: Grand Teton National Park

Source: (NPS, 2015j)

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

[128] 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 data set 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.

Bighorn Canyon National Recreation Area within Wyoming and Montana covers over 120,000 acres of spectacular views, including steep cliffs carved by the Bighorn River, roaming bighorn sheep, wide prairies, forested mountains, lakes, and wetlands (NPS, 2015k). "With over 120,000 acres, one can find an astounding diversity in ecosystems, wildlife, and more than 10,000 years of human history to explore." (NPS, 2016d)

Devils Tower National Monument is a unique geologic feature standing 867 feet atop the rolling Black Hills in northeastern Wyoming (Figure 18.1.8-4). The remarkable stone tower is an impressive visual landmark, and the views from the monument make the site an outstanding scenic resource. (NPS, 2015l)

Figure 18.1.8-4: Devils Tower National Monument

Source: (NPS, 2015m)

Fossil Butte National Monument consists of unique geological features layered with fossils of both plants and animals. The 8,198 acre park is atop high desert bluffs and descends down steep canyons with colorful soil and rock layers containing fossils (NPS, 2015n). For additional information regarding parks and recreation areas, see Section 18.1.7, Land Use, Recreation, and Airspace.

Bureau of Land Management

The BLM manages 17.5 million surface acres in Wyoming, much of the lands are high plains, sagebrush, and grasslands (BLM, 2016). These lands are managed under a multiple use mandate (Federal Land Policy Management Act of 1976 [FLPMA]) meaning that BLM must allow many uses of the lands, from recreation, to livestock grazing, forestry, wildlife habitat, and energy development (BLM, 2015c). The BLM uses their visual resources management system to "identify and evaluate scenic values to determine the appropriate levels of management." Lands that are classified with high scenic values are assigned management that prevents or reduces impacts to the visual resources, protecting the scenic landscape. (BLM, 2012) The BLM lands with high scenic values are less likely to be developed or have the visual resources disturbed. Management varies among uses and resources, some areas, like lands adjacent to wild and scenic rivers, will be managed for high quality visual resources. Other areas, such as where energy development is occurring, may be managed for lower quality visual resources.

U.S. Forest Service

There are 8 National Forests and one National Grassland managed by the USFS in Wyoming (Table 18.1.8-2) most are within the mountainous western portion of the state covering over 9 million acres (Wyoming State Parks, 2014). The USFS conducts inventories of the forest lands and assigns scenic resource categories from which they manage for scenic and visual resources in their land and resource planning efforts (about every 10-15 years) (USFS, 1995). The scenic inventories are used to manage the forest landscape and to protect areas of high scenic integrity (USFS, 1995).

Table 18.1.8-2: U.S. Forest Service Lands in Wyoming

Name	Acres (million)	Scenic Values
Ashley National Forest[a]	1.3	High desert country, high mountain areas, Kings Peak, Sheep Creek Geological Area, High Uinta Wilderness, Green River, Flaming Gorge National Recreation Area
Bighorn National Forest[b]	1	Waterfalls, meadows, forests, mountain peaks
Black Hills National Forest[c]	0.17	Geologic features, mountain peaks, hardwood forest, grasslands
Bridger-Teton National Forest[d]	3.4	Rocky mountain peaks, alpine lakes, sagebrush steppe, forests, meadows, rivers
Caribou-Targhee National Forest[e]	3	Waterfalls, cliffs of ancient volcanic material, crystal clear water, pine and fir woodlands, flowing creeks, wildlife, Beak Lake
Medicine Bow-Routt National Forests and Thunder Basin National Grassland[f]	2.9	Deciduous forest, mountain peaks, grasslands, river valleys
Shoshone National Forest[g]	2.4	Rocky mountain peaks, sagebrush steppe, forests, meadows, rivers
Wasatch-Cache National Forest[h]	0.40	Rocky mountain peaks, alpine lakes, forests, meadows, rivers

Source: [a] (USFS, 2016b) [b] (USFS, 2015c) [c] (USFS, 2015d) [d] (USFS, 2015e) [e] (USFS, 2016c) [f] (USFS, 2015f) [g] (USFS, 2015g) [h] (USFS, 2015h)

Flaming Gorge National Recreation Area is a USFS managed recreation site along the Green River spanning between Wyoming (96,223 acres) and Utah (1,287,909 acres). The scenic focal point is Flaming Gorge Reservoir surrounded by steep cliffs and mountainsides, forests, high desert, sagebrush-scrub, and colorful geology. (USFS, 2015i) (Wyoming Tourism, 2015h)

Bureau of Reclamation

The Bureau of Reclamation manages 905,600 acres of reservoirs and recreation areas (26) most often in partnership with state and federal agencies. The areas are primarily for water storage and secondary recreation use. The managing agencies that consider visual resources in their planning processes may apply management to protect scenic resources within these areas. (Wyoming State Parks, 2014)

Federal and State Trail Systems

In total, there are approximately 8,175 miles of trail in Wyoming, most of which is managed by the USFS (6,186 miles), about 143 miles are managed by the state or local entities. (Wyoming Trails, 2015)

The Continental Divide National Scenic Trail is an ongoing project to connect Mexico and the Canadian border. The 3,105 mile-trail traverses Wyoming (550 miles), Montana/Idaho (980 miles), Colorado (800 miles), and New Mexico (775 miles). The trail crosses through some of the most rugged and breathtaking terrain in Wyoming, such as "Yellowstone National Park, BLM lands, and the Bridger/Teton, Shoshone, and Medicine Bow-Routt National Forests" (Continental Divide Trail Coalition, 2016). The trail is designated by Congress under the National Trails System Act (16 U.S.C. 1241-1251, as amended), and is protected under those provisions (NPS, 2012a).

There are 14 National Recreation Trails in Wyoming (National Recreation Trails, 2015b). "National Recreation Trails may be designated by the Secretary of Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization" (National Recreation Trails, 2015c). In Wyoming, the trails are managed by several federal agencies or local governments. The names, miles of trails and managing agency are listed in Table 18.1.8-3.

Table 18.1.8-3: National Recreation Trails

Name and Managing Agency	Miles
Beartooth Loop (USFS)	9.7
Blackwater Fire Memorial (USFS)	6.0
Bucking Mule Falls (USFS)	17.0
Grassroots (Torrington)	0.9
Headquarters (USFS)	3.5
Lee McCune Braille (Natrona County)	0.3
Morning Glory (NPS)	1.5
Muddy Mountain Interpretive Nature Trail (BLM)	2.0
Rock Creek – Deep Creek (USFS)	14.0
Shell Falls (USFS)	0.2
Sheridan (USFS)	9.0
South Rim (NPS)	9.0
Three Senses (NPS)	0.2
Wyoming Range (USFS)	70.0
Total	**143.3**

Source: (National Recreation Trails, 2015b)

State Parks

Wyoming has 11 state parks and 1 state recreation area that range from 50 to 15,145 acres in size (Wyoming State Parks, 2016). Every location features remarkable scenic resources ranging from unique geologic features, to pristine mountain ranges, or wide-open vistas of rivers, lakes and prairies (Table 18.1.8-4).

Table 18.1.8-4: Wyoming State Parks and Associated Visual Attributes

Name	Acres	Scenic Values
Bear River State Park	293	Bear River, riparian forest, rolling hills, sagebrush-scrub
Boysen State Park	15,618	Wind River, Wind River mountain vistas, geologic formations, lake, steep canyons, forests
Buffalo Bill State Park	13,571	Shoshone River, lake view, Absaroka Mountains, steep canyons, forest
Curt Gowdy State Park	3,393	Lakes, canyons, meadows, geologic formations, forest
Edness K. Wilkins State Park	355	North Platte River, riparian forest, grassland
Glendo State Park	21,949	Lake, North Platte River, forest, steep canyons
Guernsey State Park	8,591	Lake, North Platte River, forest, steep canyons
Hawk Springs State Recreation Area	50	Riparian forest, lake, high desert plateaus
Hot Springs State Park	945	Big Horn River, hot springs, geologic features, manicured gardens,
Keyhole State Park	15,844	Lake view, Black Hills, Belle Fourche River, forest, steep canyons
Seminoe State Park	34,202	Lake, North Platte River, Medicine Bow River, sand dunes, mountains, high desert, grassland,
Sinks Canyon State Park	1,051	Popo Agie River, geologic features, steep canyon, riparian forest
Total[ab]	**115,862**	

Source: (Wyoming State Parks, 2015a)

[a] The total for Table 18.1.8-4 includes acreage for open water per GIS data.

[b] Wyoming State Parks are comprised of "49,000 Acres of Land" (Wyoming State Parks, 2015c).

Wyoming also boasts many county and city managed parks and recreation areas that contain scenic resources. Ayers Natural Bridge and Park is a 150-acre park managed by Converse County in Douglas, Wyoming. This park's visual gem is the natural bridge arching over LaPrele Creek, which is only one of 3 natural rock bridges in the country that spans over water. (Converse County, 2015)

State Forests

The Wyoming State Forestry Division manages 263,000 acres of trust lands for timber harvest, watershed, wildlife habitat, and recreation. Scenic resources within the forests may vary depending on how the forest area is managed. (Wyoming State Forestry Division, 2015b)

18.1.8.6. Natural Areas

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). Wyoming has 408 miles of rivers designated as wild and scenic on the Snake and Yellowstone Rivers (National Wild and Scenic Rivers System, 2015a). The 387.5 miles of designated sections of the Snake River Headwaters contain all three classifications of wild (217.9 miles), scenic (140.6 miles), and recreational (29 miles) (National Wild and Scenic Rivers

System, 2015b). The Clarks Fork of the Yellowstone River has 20.5 miles of wild designation (National Wild and Scenic Rivers System, 2015c). The scenic resources of these rivers are protected by the federal designations (Figure 18.1.4-2: Wild and Scenic Snake River Headwaters, Granite Creek).

National Wildlife Refuges (NWR) and State Wildlife Management Areas

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, 2015v). There are 7 NWRs, as follows, across Wyoming covering about 100,000 acres:

- Bamforth NWR
- Cokeville Meadows NWR
- Hutton Lake NWR
- Mortenson Lake NWR
- National Elk Refuge NWR
- Pathfinder NWR
- Seedskadee NWR

Many of these refuges encompass lakes, rivers, or wetlands and surrounding habitat; however other areas are within upland habitat and forested areas, such as the National Elk Refuge. These refuges protect hundreds of thousands of acres of habitat and the visual resources within and surrounding the refuges. (USFWS, 2015w)

Wyoming Game and Fish Department allows access to about 413,000 acres for access to lands for fishing and hunting, which includes the 39 wildlife habitat management areas across the state. Visual resources vary from high mountain peaks to river valleys, forests, sagebrush, and grasslands. (WGFD, 2015c; WGFD, 2014d)

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. The 6 NNLs in Wyoming cover over 25,000 acres owned by a variety of federal, state, and private entities. Table 18.1.8-5 displays a list of NNLs, their size, and some of the scenic resources protected within these areas. (NPS, 2012b)

Table 18.1.8-5: National Natural Landmarks with Scenic Resources

National Natural Landmarks	Acres	Visual Resources
Big Hollow	12,862	Unique geologic feature, wide-open vistas, specialized grassland habitat
Como Bluff	1,617	Geologic and paleontological, grassland, wide-open vistas
Crooked Creek Natural Area	281	Geologic and paleontological, wide-open vistas
Red Canyon	4,745	Geologic, colorful stone, steep cliffs, grassland
Sand Creek	5,118	Geologic features, paleontological, grassland
Two Ocean Pass	2,124	Geologic, mountain top vistas, meadow, forests

Source: (NPS, 2012b)

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" (NPS, 2015o). Over 106 million acres of federal public lands across the U.S. have been designated as wilderness areas. Twenty-five percent of these federal lands are located in 47 national parks (44 million acres) and are part of National Park System. These designated wilderness areas are managed by USFS, BLM, USFWS, and NPS (NPS, 2015o). There are 15 designated wilderness areas covering about 3.0 million acres throughout the state; and all are managed under the jurisdiction of the USFS (Table 18.1.8-6) (Wilderness.net, 2015).

Table 18.1.8-6: Congressionally Designated Wilderness in Wyoming

Wilderness Area	Acres
Absaroka-Beartooth Wilderness	23,694
Bridger Wilderness	392,160
Cloud Peak Wilderness	191,914
Encampment River Wilderness	10,240
Fitzpatrick Wilderness	191,103
Gros Ventre Wilderness	285,505
Huston Park Wilderness	30,895
Jedediah Smith Wilderness	123,924
North Absaroka Wilderness	351,104
Platte River Wilderness	22,558
Popo Agie Wilderness	102,620
Savage Run Wilderness	15,271
Teton Wilderness	557,311
Washakie Wilderness	686584
Winegar Hole Wilderness	10,642
Total	**3,067,687**

Sources: (Wilderness.net, 2015) (USEPA, 2012a)

National Grassland

The USFS administers both National Forests (Section 18.1.8.5) and National Grasslands. There is one National Grassland in Wyoming, the Thunder Basin National Grassland. The landscape has lush, rolling hills and wide open vistas protected by the visual resource management of the USFS. (USFS, 2014b)

18.1.8.7. Additional Areas

National and State Scenic Byways

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

Byways Program is managed by the FHWA (FHWA, 2015e). There is one National Scenic Byway in Wyoming, the 68.7 mile Beartooth Highway that is an access route into Yellowstone National Park. The road winds through the Beartooth Mountain Range and contains magnificent scenic views of mountains, rivers, and alpine meadows (FHWA, 2015f).

Wyoming has 16 state scenic and historic byways, highways, skyways, and backways. Table 18.1.8-7 shows the routes, miles, some of the scenic resources that are found along the roadways.

Table 18.1.8-7: Wyoming State Scenic and Historic Routes

Name	Miles	Scenic Values
Beartooth Scenic Byway	47 (WY)	Forest, mountain peaks, lush meadows, waterfalls, canyons
Bighorn Scenic Byway (US 14)	58	Forest, mountain peaks, lush meadows, waterfalls, canyons
Big Spring Scenic Backway	68	River valleys, Tunp Mountain Range, Bridger National Forest
Bridger Valley Historic Byway	18	Historic towns, historical sites
Buffalo Bill Cody Scenic Byway	27.5	Shoshone River, geologic features
Chief Joseph Scenic Highway	47	Shoshone National Forest, Absaroka Mountains, Clarks Fork Valley, Beartooth Mountains, Yellowstone River, North Absaroka Wilderness
Cloud Peak Skyway	47	Big Horn National Forest, Big Horn Mountains, Cloud peak, limestone walls, canyons
Flaming Gorge - Green River Basin Scenic Byway	100	Redrock country, Green River-Colorado drainage basin, high desert, rock formations, mountain peaks
Mirror Lake Scenic Byway - WY Section	20	Uinta Mountains, alpine landscape
Muddy Creek Historic Backway	25	Muddy Greek, western ghost town
Red Gulch/Alkali National Back Country Byway	34	Big Horn Mountains, colorful geography, Big Horn Basin
Snowy Range Scenic Byway	29	Medicine Bow-Routt National Forest
South Big Horn/Red Wall Scenic Backway	102	Big Horn Mountain Range, prairie, wildlife, sage, rangelands
Star Valley Scenic Byway	80	Climb Salt Canyon, Salt River Pass, Snake River Canyon, wilderness, rivers, wildlife, snow capped mountains
Wind River Canyon Scenic Byway	34	Wind River, Bighorn River, Owl Creek Mountains, Boysen Reservoir, Wind River Canyon, rock walls, ridge tops, rock formations, black and pink cliffs, geologic features
Wyoming Centennial Scenic Byway	163	Bad lands, ranchlands, high montane
Total	**904.5**	

Sources: (Wyoming Tourism, 2016c) (America's Scenic Byways, 2016) (Wyoming Tourism, 2016d) (Wyoming Tourism, 2016e) (Wyoming Tourism, 2016f) (Go-Wyoming, 2016) (Wyoming Tourism, 2016g) (Wyoming Tourism, 2016h) (Wyoming Tourism, 2016i)

18.1.9. Socioeconomics

18.1.9.1. Definition of the Resource

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

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet's mission is to provide public safety broadband and interoperable emergency communications coverage throughout the nation. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes. The financial arrangements for deployment and operation of the FirstNet network have socioeconomic implications. Section 1.1 frames some of the public expenditure and public revenue considerations specific to FirstNet; however this is not intended to be either descriptive or prescriptive of FirstNet's financial model or anticipated total expenditures and revenues associated with the deployment of the NPSBN. This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898 (see Section 1.8, Overview of Relevant Federal Laws and Executive Orders). This PEIS addresses environmental justice in a separate section (Section 18.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use, recreation, and airspace (Section 18.1.7), infrastructure (Section 18.1.1), and aesthetic considerations (Section 18.1.8).

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau (Census Bureau) and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this PEIS. In all cases, this section uses the most recent data available for each geography at the time of writing. At the county, state, region, and United States levels, the data are typically for 2013 or 2014. For smaller geographic areas, this section uses data from the Census Bureau's American Community Survey (ACS). The ACS is the Census Bureau's flagship demographic estimates program for years other than the decennial census years. This PEIS uses the 2009-2013 ACS, which is based on surveys (population samples) taken across that five-year period; thus, it is not appropriate to attribute its data values to a specific year. It is a valuable source because it provides the most accurate and consistent socioeconomic data across the nation at the sub-county level (U.S. Census Bureau, 2016).[129]

[129] 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"

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.

18.1.9.2. Specific Regulatory Considerations

Research for this section did not identify any specific state, local, or tribal laws or regulations that are directly relevant to socioeconomics for this PEIS.

18.1.9.3. Communities and Populations

This section discusses the population and major communities of Wyoming (WY) and includes the following topics:

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

Statewide Population and Population Growth

Table 18.1.9-1 presents the 2014 estimated population and population density of Wyoming in comparison to the Central region[130] and the nation. The estimated population of Wyoming in 2014 was 584,153. The population density was 6 persons per square mile (sq. mi.), which was considerably lower than the population density of both the region (66 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Wyoming was the smallest state by estimated population among the 50 states and the District of Columbia, 9th largest by land area, and had the 2nd lowest population density (U.S. Census Bureau, 2015c; U.S. Census Bureau, 2015d).

choices, select "Dataset," then select the dataset indicated in the reference; e.g. "American Community Survey, 2013 1-Year Estimates" or "2012 Census of Governments." Click "Close." Note: ACS is the abbreviation in the AFF for the American Community Survey. SF is the abbreviation used with the 2000 and 2010 "Summary Files." For references to the "2009-2013 5-Year Summary File," choose "2013 ACS 5-year estimates" in the AFF. 4) Click the "Geographies" box. Under "Select a geographic type," choose the appropriate type; e.g. "United States – 010" or "State – 040" or "..... County – 050" then select the desired area or areas of interest. Click "Add to Your Selections," then "Close." For Population Concentration data, select "Urban Area - 400" as the geographic type, then select 2010 under "Select a version" and then choose the desired area or areas. Alternatively, do not choose a version, and select "All Urban Areas within United States." Regional values cannot be viewed in the AFF because the regions for this PEIS do not match Census Bureau regions. All regional values were developed by downloading state data and using the most mathematically appropriate calculations (e.g., sums of state values, weighted averages, etc.) for the specific data. 5) In "Refine your search results," type the table number indicated in the reference; e.g. "DP04" or "LGF001." The dialogue box should auto-populate with the name of the table(s) to allow the user to select the table number/name. Click "Go." 6) In the resulting window, click the desired table under "Table, File, or Document Title" to view the results. If multiple geographies were selected, it is often easiest to view the data by clicking the "Download" button above the on-screen data table. Choose the desired comma-delimited format or presentation-ready format (includes a Microsoft Excel option). In some cases, the structure of the resulting file may be easier to work with under one format or another. Note that in most cases, the on-screen or downloaded data contains additional parameters besides those used in the FirstNet PEIS report table. Readers must locate the FirstNet PEIS-specific data within the Census Bureau tables. In many cases, the FirstNet PEIS report tables contain data from multiple Census Bureau tables and sometimes incorporate other sources.

[130] The Central region is comprised of the states of Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Wyoming, Nebraska, North Dakota, Ohio, South Dakota, Utah, Wisconsin, and Wyoming. Throughout the socioeconomics section, figures for the Central 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 Central region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

Table 18.1.9-1: Land Area, Estimated Population, and Population Density of Wyoming

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Wyoming	97,093	584,153	6
Central Region	1,178,973	77,651,608	66
United States	3,531,905	318,857,056	90

Sources: (U.S. Census Bureau, 2015c; U.S. Census Bureau, 2015d)

Estimated population growth is an important subject for this PEIS given FirstNet's mission. Table 18.1.9-2 presents the population growth trends of Wyoming from 2000 to 2014 in comparison to the Central region and the nation. The state's annual growth rate slowed in the 2010 to 2014 period compared to 2000 to 2010, declining from 1.33 percent to 0.90 percent. The growth rate of Wyoming in the latter period was twice the rate of the region (0.45 percent) and slightly higher than the growth rate of the nation, at 0.81 percent.

Table 18.1.9-2: Recent Population Growth of Wyoming

Geography	Estimated Population			Numerical Estimated Population Change		Rate of Estimated Population Change (AARC)[a]	
	2000	2010	2014	2000 to 2010	2010 to 2014	2000 to 2010	2010 to 2014
Wyoming	493,782	563,626	584,153	69,844	20,527	1.33%	0.90%
Central Region	72,323,183	76,273,123	77,651,608	3,949,940	1,378,485	0.53%	0.45%
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, 2015c) (U.S. Census Bureau, 2015x)

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

Demographers prepare future estimated population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use estimated population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore, Table 18.1.9-3 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 Wyoming's estimated population will increase by approximately 74,371 people, or 12.7 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.75 percent, which is slightly lower than the historical growth rate from 2010 to 2014 of 0.90 percent. The projected growth rate of the state is slightly higher than that of the region (0.60 percent) and somewhat lower than the projected growth rate of the nation (0.80 percent).

Table 18.1.9-3: Projected Estimated Population Growth of Wyoming

Geography	Estimated Population 2014	Projected 2030 Estimated Population			Change Based on Average Projection		
		University of Virginia 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
Wyoming	584,153	621,916	695,132	658,524	74,371	12.7%	0.75%
Central Region	77,651,608	83,545,838	87,372,952	85,459,395	7,807,787	10.1%	0.60%
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, 2015c; ProximityOne, 2015; University of Virginia Weldon Cooper Center, 2015)
AARC = Average Annual Rate of Change (compound growth rate)

Population Distribution and Communities

Figure 18.1.9-1 presents the distribution and relative density of the estimated population of Wyoming. 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, 2015e).

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, 2015w). 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 map shows that much of Wyoming is very sparsely populated.

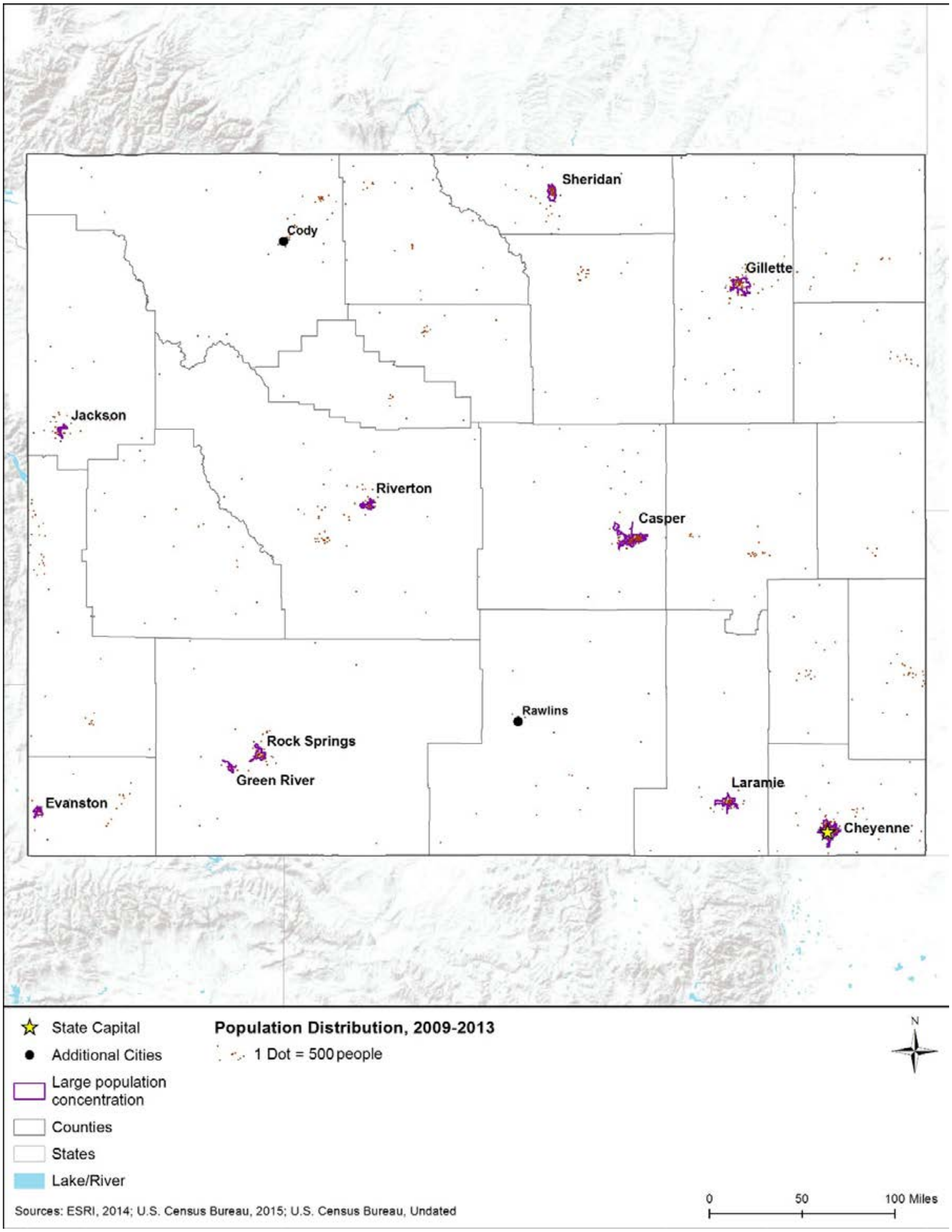


Figure 18.1.9-1: Estimated Population Distribution in Wyoming, 2009–2013

Table 18.1.9-4 provides the populations of the 10 largest population concentrations in Wyoming, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses. In 2010, the largest population concentration was the Cheyenne area, which had 73,588 people. The smallest of these 10 population concentrations was the Jackson area, with a 2010 population of 11,407. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Gillette area, with an annual growth rate of 4.76 percent.

However, this large population increase reflects a change in the area definition, from 11 sq. mi. in 2000 to 25 sq. mi. in 2010. This area expansion may have taken in some existing population; thus, the growth rate of this area may reflect this factor as well as organic growth (net in-migration and/or births exceeding deaths). The Rock Springs area experienced the second fastest growth during this period (2.03 percent).

Table 18.1.9-4 also shows that the top 10 population concentrations in Wyoming accounted for 52.6 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 56.0 percent of the entire state's growth.

Table 18.1.9-4: Population of the 10 Largest Population Concentrations in Wyoming

Area	Population			Population Change 2000 to 2010		
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Casper	57,719	64,548	66,052	2	6,829	1.12%
Cheyenne	68,202	73,588	74,759	1	5,386	0.76%
Evanston	11,558	12,017	11,805	9	459	0.39%
Gillette*	20,560	32,721	33,173	3	12,161	4.76%
Green River	11,939	12,672	12,758	7	733	0.60%
Jackson	10,072	11,407	11,942	10	1,335	1.25%
Laramie	28,139	31,965	32,747	4	3,826	1.28%
Riverton	10,432	12,265	12,463	8	1,833	1.63%
Rock Springs	21,555	26,352	26,986	5	4,797	2.03%
Sheridan	17,046	18,786	18,649	6	1,740	0.98%
Total for Top 10 Population Concentrations	**257,222**	**296,321**	**301,334**	**Not applicable (NA)**	**39,099**	**1.43%**
Wyoming (statewide)	**493,782**	**563,626**	**570,134**	**NA**	**69,844**	**1.33%**
Top 10 Total as Percentage of State	**52.1%**	**52.6%**	**52.9%**	**NA**	**56.0%**	**NA**

Sources: (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015b) (U.S. Census Bureau, 2015f)

AARC = Average Annual Rate of Change (compound growth rate)
*The large population increase from 2000 to 2010 reflects a large change in the area definition for the Gillette urban cluster, from 11 sq. mi. in 2000 to 25 sq. mi. in 2010.

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

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

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

Social institutions – educational, family, political, public service, military, and religious – are present throughout the state. The institutions most relevant to FirstNet projects are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 18.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 18.1.9-5 compares several economic indicators for Wyoming to the Central region and the nation. The table presents two indicators of income[131] – 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 18.1.9-5, the per capita income in Wyoming in 2013 ($28,889) was $1,361 higher than that of the region ($27,528), and $705 higher than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 18.1.9-5 shows that in 2013, the MHI in Wyoming ($58,424) was $6,379 higher than that of the region ($52,045), and $6,174 higher than that of the nation ($52,250).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the unemployment rate as the number of unemployed individuals who are looking for work divided

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

by the total number of individuals in the labor force. Table 18.1.9-5 compares the unemployment rate in Wyoming to the Central region and the nation. In 2014, Wyoming's statewide unemployment rate of 4.3 percent was lower than the rate for the region (5.7 percent) and the rate for the nation (6.2 percent).[132]

Table 18.1.9-5: Selected Economic Indicators for Wyoming

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Wyoming	$28,889	$58,424	4.3%
Central Region	$27,528	$52,045	5.7%
United States	$28,184	$52,250	6.2%

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

Figure 18.1.9-2 and Figure 18.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015g) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 18.1.9-1 (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015w). 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 Wyoming.

Figure 18.1.9-2 shows that, at the county level, MHI in 2013 had a variable distribution across the state, with high and low MHI levels occurring throughout the state. The counties classified as having the highest MHI levels encompassed seven of the top 10 population concentrations but also included some counties without any such populations. Table 8.1.9-6 shows that MHI in the 10 largest population concentrations in Wyoming ranged from $38,594 in the Laramie area to $75,804 in the Gillette area; the state average was $57,406.

Figure 18.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that all counties in Wyoming had unemployment rates below the national average (that is, better employment performance). When comparing unemployment in the population concentrations to the state average, most areas had a 2009–2013 unemployment rate that was within two percentage points of the state average (7.3 percent). Only one area, Riverton, had an unemployment rate (i.e., 10.6 percent) considerably higher than the state average. The lowest unemployment rate was in the Jackson area, at 3.1 percent.

Detailed employment data provides useful insights into the nature of a local, state, or national economy. Table 18.1.9-7 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

[132] The unemployment rates can change quarterly.

salary workers was considerably lower in Wyoming than in the Central region and the nation. The percentage of government workers was substantially higher in the state than in the region and nation. Self-employed workers were a somewhat higher percentage in the state than in the region or nation.

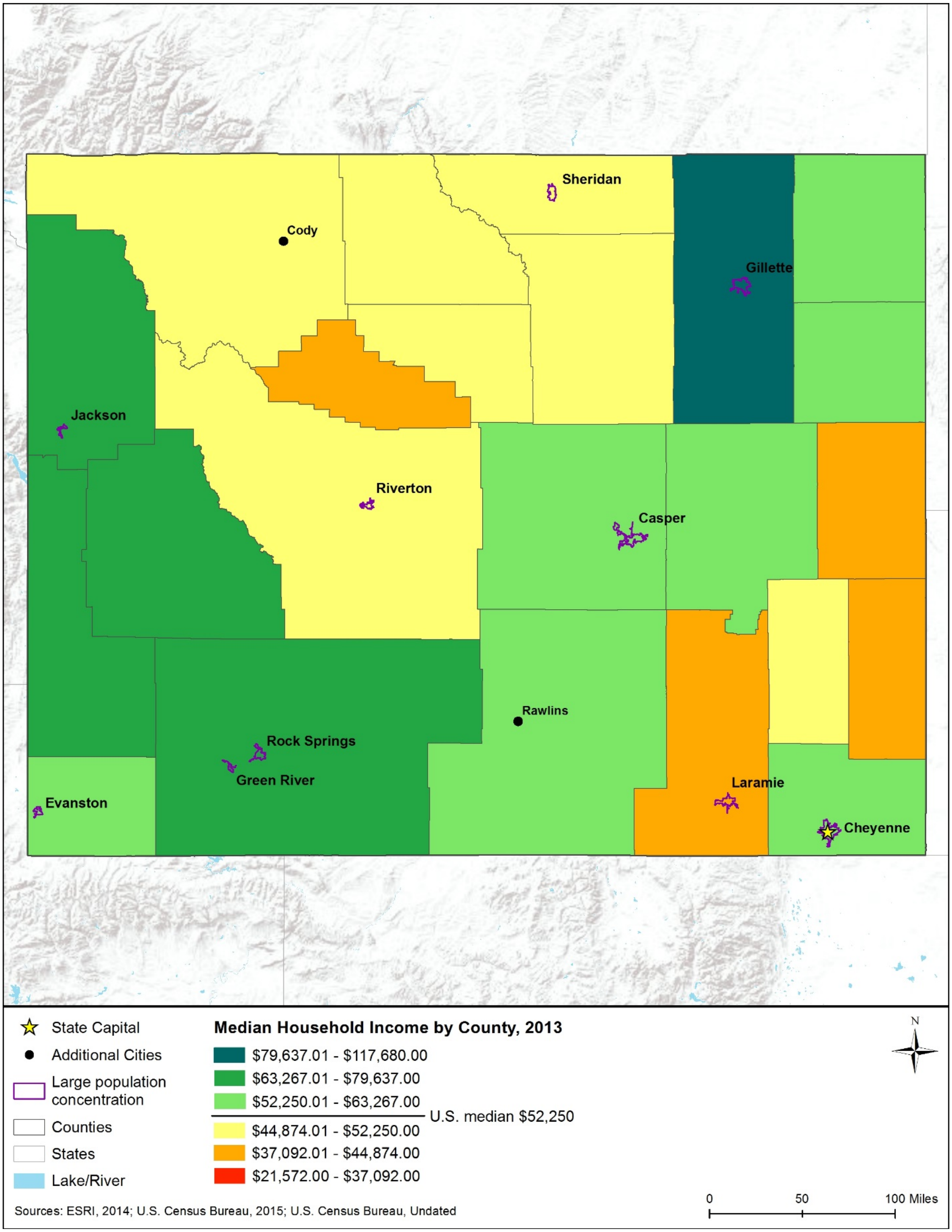


Figure 18.1.9-2: Median Household Income in Wyoming, by County, 2013

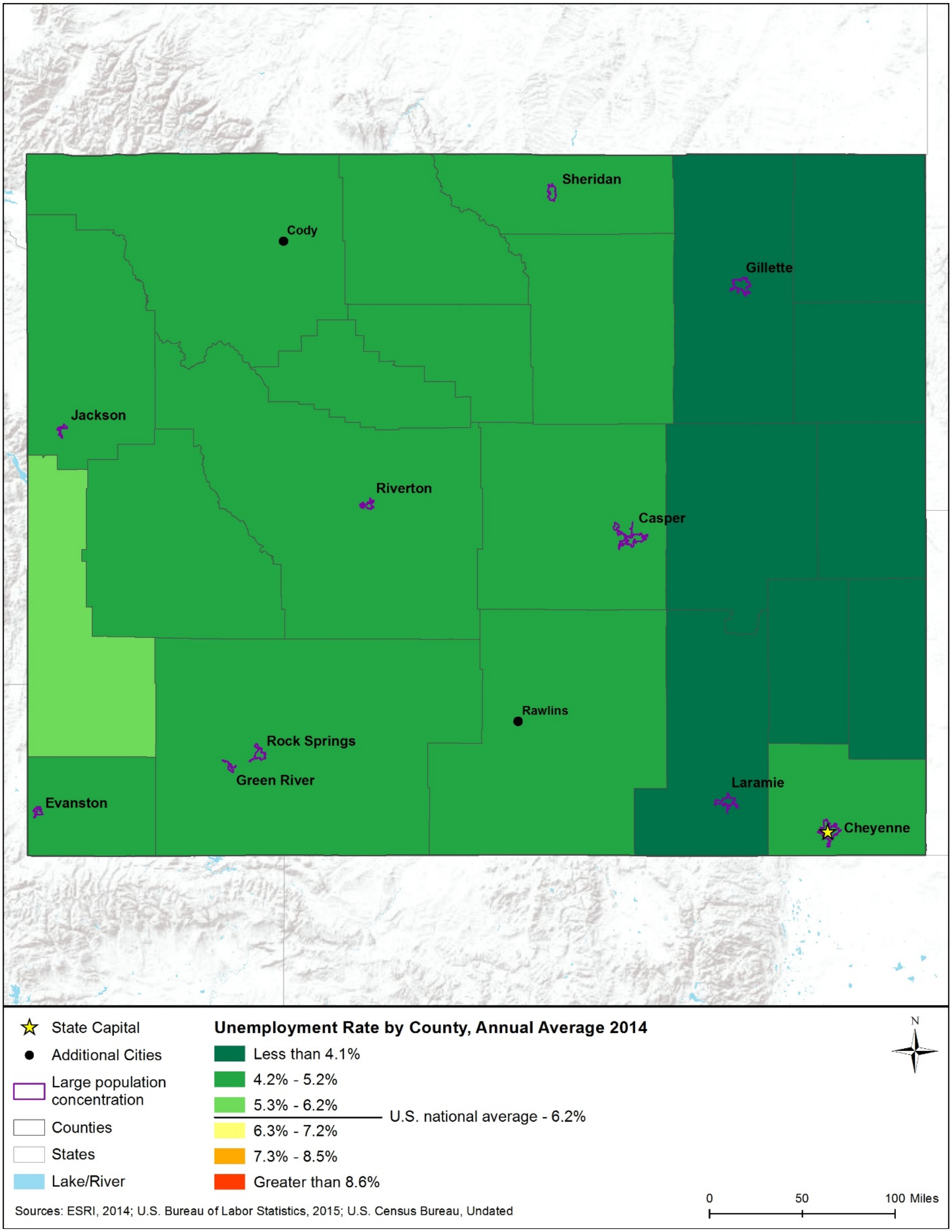


Figure 18.1.9-3: Unemployment Rates in Wyoming, by County, 2014

By industry, Wyoming has a mixed economic base and some notable figures in the table are as follows. Wyoming in 2013 had a considerably higher percentage of persons working in "agriculture, forestry, fishing and hunting, and mining" and "public administration" than did the region or the nation. It had a considerably lower percentage of persons working in "manufacturing" and "professional, scientific, management, administrative, and waste management services" than the region or nation. It also had a lower percentage of persons working in "finance and insurance, and real estate and rental and leasing" than the region and nation. Employment shares for all other industries in Wyoming were generally within two percentage points of the regional and national figures.

Table 18.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Wyoming, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Casper	$54,770	5.9%
Cheyenne	$51,069	6.3%
Evanston	$50,393	7.0%
Gillette	$75,804	4.6%
Green River	$75,181	6.8%
Jackson	$66,723	3.1%
Laramie	$38,594	5.2%
Riverton	$39,984	10.6%
Rock Springs	$67,431	6.6%
Sheridan	$45,558	5.7%
Wyoming (statewide)	$57,406	5.5%

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

Table 18.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Wyoming	Central Region	United States
Civilian Employed Population 16 Years and Over	295,192	36,789,905	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	70.0%	81.7%	79.7%
Government workers	23.5%	12.8%	14.1%
Self-employed in own not incorporated business workers	6.1%	5.3%	6.0%
Unpaid family workers	0.4%	0.2%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	13.1%	2.2%	2.0%
Construction	6.5%	5.6%	6.2%
Manufacturing	3.7%	14.0%	10.5%
Wholesale trade	1.9%	2.7%	2.7%
Retail trade	11.9%	11.5%	11.6%

Class of Worker and Industry	Wyoming	Central Region	United States
Transportation and warehousing, and utilities	6.2%	4.9%	4.9%
Information	1.0%	1.9%	2.1%
Finance and insurance, and real estate and rental and leasing	4.0%	6.5%	6.6%
Professional, scientific, management, administrative, and waste management services	5.9%	9.7%	11.1%
Educational services, and health care and social assistance	24.6%	23.4%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	9.8%	9.1%	9.7%
Other services, except public administration	4.3%	4.6%	5.0%
Public administration	7.3%	3.9%	4.7%

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

Table 18.1.9-8 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 18.1.9-7 for 2013.

Table 18.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in Wyoming, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Casper	8.1%	6.9%	1.7%	7.1%
Cheyenne	7.3%	6.2%	2.7%	7.5%
Evanston	5.1%	5.8%	1.1%	5.5%
Gillette	8.9%	7.2%	1.0%	6.3%
Green River	5.3%	8.7%	0.7%	3.0%
Jackson	5.4%	4.3%	2.0%	10.9%
Laramie	4.4%	3.4%	1.2%	7.6%
Riverton	8.3%	3.4%	2.0%	5.0%
Rock Springs	8.6%	8.4%	1.1%	5.7%
Sheridan	10.1%	5.6%	2.7%	10.2%
Wyoming (statewide)	7.8%	6.6%	1.6%	6.6%

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

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 18.1.9-9 compares Wyoming to the Central region and nation on several common housing indicators.

As shown in Table 18.1.9-9, in 2013, Wyoming had a lower percentage of housing units that were occupied (84.4 percent) than the region (88.4 percent) or nation (87.6 percent). Of the occupied units, Wyoming had a slightly higher percentage of owner-occupied units (69.1 percent) than the region (67.6 percent) and the nation (63.5 percent). The percentage of detached single-unit housing (also known as single-family homes) in Wyoming in 2013 was 66.8 percent, somewhat lower than the region (67.7 percent) and slightly higher than the nation (61.5 percent). The homeowner vacancy rate in Wyoming (1.4 percent) was slightly lower than the rate for both the region (1.8 percent) and the nation (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015l). The vacancy rate among rental units was higher in Wyoming (8.1 percent) than in the region (6.0 percent) and nation (6.5 percent).

Table 18.1.9-9: Selected Housing Indicators for Wyoming, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Wyoming	265,471	84.4%	69.1%	1.4%	8.1%	66.8%
Central Region	33,580,411	88.4%	67.6%	1.8%	6.0%	67.7%
United States	132,808,137	87.6%	63.5%	1.9%	6.5%	61.5%

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

Table 18.1.9-10 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 18.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Wyoming, 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
Casper	29,602	91.8%	67.9%	1.9%	6.1%	70.3%
Cheyenne	32,993	90.4%	62.9%	1.5%	5.1%	57.7%
Evanston	4,816	84.9%	64.8%	1.5%	19.7%	49.5%
Gillette	13,773	88.6%	69.9%	2.2%	8.4%	51.5%
Green River	5,119	91.9%	71.7%	1.7%	8.8%	66.0%
Jackson	5,319	75.7%	49.8%	2.3%	13.5%	44.2%
Laramie	15,210	88.5%	46.7%	1.6%	5.8%	45.0%

Area	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Riverton	5,522	91.5%	63.7%	0.0%	9.5%	60.6%
Rock Springs	11,539	89.5%	70.0%	1.0%	8.7%	52.6%
Sheridan	8,612	92.0%	61.2%	1.4%	4.6%	64.4%
Wyoming (statewide)	263,040	84.7%	70.1%	1.7%	8.0%	66.4%

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

Table 18.1.9-10 shows that during this period the percentage of occupied housing units exceeded the state average of 84.7 percent in all areas, except in the Jackson area (75.7 percent).

Property Values

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

Table 18.1.9-11 provides indicators of residential property values for Wyoming and compares these values to values for the Central 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, 2015l).

The table shows that the median value of owner-occupied units in Wyoming in 2013 ($195,500) was higher than the corresponding values for the Central region ($151,200) and for the nation ($173,900).

Table 18.1.9-11: Residential Property Values in Wyoming, 2013

Geography	Median Value of Owner-Occupied Units
Wyoming	$195,500
Central Region	$151,200
United States	$173,900

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

Table 18.1.9-12 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 in the top 10 population concentrations ranged from $150,900 (Riverton area) to $202,000 (Green River area), with the exception of the Jackson area, which had a much higher figure, $568,800. The state average was $185,900.

Table 18.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Wyoming, 2009–2013

Area	Median Value of Owner-Occupied Units
Casper	$176,500
Cheyenne	$166,600
Evanston	$185,000
Gillette	$200,200
Green River	$202,000
Jackson	$568,800
Laramie	$194,200
Riverton	$150,900
Rock Springs	$168,400
Sheridan	$189,700
Wyoming (statewide)	$185,900

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

Government Revenues

State and local governments obtain revenues from many sources. FirstNet may affect flows of revenue sources between different levels of government due to program financing and intergovernmental agreements for system development and operation. Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 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 18.1.9-13 presents total and selected state and local government revenue sources as reported by the Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures are particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure.

General and selective sales taxes may change, reflecting expenditures during system development and maintenance. Table 18.1.9-13 shows that state and local governments in Wyoming received much less total revenue in 2012 on a per capita basis than their counterpart governments in the region and nation. Additionally, Wyoming state and local governments had considerably lower per capita levels (less than half) of intergovernmental revenues[133] from the federal government. The state government in Wyoming obtained higher levels of property taxes

[133] 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).

per capita than its counterparts in the region and nation, while local governments obtained considerably lower levels of property taxes per capita than local governments in the region and nation. Wyoming state and local governments reported lower levels of per capita revenue from general sales taxes than their counterparts in the region and nation. Wyoming state and local governments also obtained less revenue from selective sales taxes on a per capita basis than counterparts in the region and nation, and minimal public utility tax revenue. State and local governments in Wyoming reported no revenue from individual or corporate income taxes.

Table 18.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue		Wyoming		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$6,845	$4,705	$463,192	$231,980	$1,907,027	$1,615,194
	Per capita	$2,397	$1,648	$6,020	$3,015	$6,075	$5,145
Intergovernmental from Federal	($M)	$2,213	$125	$125,394	$9,383	$514,139	$70,360
	Per capita	$775	$44	$1,630	$122	$1,638	$224
Intergovernmental from State	($M)	$0	$1,611	$0	$76,288	$0	$469,147
	Per capita	$0	$564	$0	$992	$0	$1,495
Intergovernmental from Local	($M)	$229	$0	$2,721	$0	$19,518	$0
	Per capita	$80	$0	$35	$0	$62	$0
Property Taxes	($M)	$317	$1,003	$3,626	$61,015	$13,111	$432,989
	Per capita	$111	$351	$47	$793	$42	$1,379
General Sales Taxes	($M)	$994	$208	$58,236	$6,920	$245,446	$69,350
	Per capita	$348	$73	$757	$90	$782	$221
Selective Sales Taxes	($M)	$126	$36	$33,313	$2,191	$133,098	$28,553
	Per capita	$44	$13	$433	$28	$424	$91
Public Utilities Taxes	($M)	$4	$20	$3,627	$1,153	$14,564	$14,105
	Per capita	$2	$7	$47	$15	$46	$45
Individual Income Taxes	($M)	$0	$0	$72,545	$5,148	$280,693	$26,642
	Per capita	$0	$0	$943	$67	$894	$85
Corporate Income Taxes	($M)	$0	$0	$9,649	$310	$41,821	$7,210
	Per capita	$0	$0	$125	$4	$133	$23

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

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

18.1.10. Environmental Justice

18.1.10.1. Definition of the Resource

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,* issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO (*see* Section 1.8.12, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Population). 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, 2016c). Under the EO, each federal agency must "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Office of the President, 1994). In response to the EO, the DOC developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (DOC, 2013).

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

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

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

18.1.10.2. 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. Wyoming does not have a formal state policy to address environmental justice. The WDEQ adopts and operates under federal environmental justice guidance. (University of California, Hastings College of Law, 2010)

18.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 18.1.10-1 presents 2013 data on the composition of Wyoming's estimated population by race and by Hispanic origin. The state's estimated population has considerably lower percentages of individuals who identify as Black/African American (1.3 percent), Asian (1.0 percent), or Some Other Race (1.9 percent) than the estimated populations of the Central region and the nation. Those percentages are, for Black/African American, 9.3 percent for the Central region and 12.6 percent for the nation; for Asian, 2.8 percent and 5.1 percent respectively; and for Some Other Race, 2.4 percent and 4.7 percent respectively. Wyoming has a higher percentage of individuals who identify as American Indian/Alaska Native (2.3 percent) than does the region (0.7 percent) or the nation (0.8 percent). The state's estimated population of persons identifying as White (90.7 percent) is larger than that of the Central region (82.2 percent) or the nation (73.7 percent).

The percentage of the estimated population in Wyoming that identifies as Hispanic (8.9 percent) is somewhat higher than in the Central region (8.5 percent) and considerably lower (almost half) than in 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. Wyoming's All Minorities estimated population percentage (15.3 percent) is lower than that of the Central region (23.3 percent) and considerably lower (less than half) than the nation's value (37.6 percent).

Table 18.1.10-2 presents the percentage of the estimated population living in poverty in 2013, for the state, region, and nation. The figure for Wyoming (10.9 percent) is lower than that for the Central region (14.7 percent) and the nation (15.8 percent).

Table 18.1.10-1: Estimated Population by Race and Hispanic Status, 2013

Geography	Total Estimated Population	Race							Hispanic	All Minorities
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
Wyoming	582,658	90.7%	1.3%	2.3%	1.0%	0.0%	1.9%	2.7%	8.9%	15.3%
Central Region	77,314,952	82.2%	9.3%	0.7%	2.8%	0.1%	2.4%	2.5%	8.5%	23.3%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

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

"All Minorities" is defined as all persons who consider themselves Hispanic or of any race other than White. Because some Hispanics identify as both Hispanic and of a non-White race, "All Minorities" is less than the sum of Hispanics and non-White races.

Table 18.1.10-2: Percentage of Estimated Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Wyoming	10.9%
Central Region	14.7%
United States	15.8%

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

18.1.10.4. 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 18.1.10-1 visually portrays the results of the environmental justice population screening analysis for Wyoming. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015s; U.S. Census Bureau, 2015t; U.S. Census Bureau, 2015u; U.S. Census Bureau, 2015v) and Census Bureau urban classification data (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015w).

Figure 18.1.10-1 shows that Wyoming has many areas with high and moderate potential for environmental justice populations. The distribution of both high and moderate potential areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations.

It is important to understand how the data behind Figure 18.1.10-1 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 18.1.10-1 does not definitively identify environmental justice populations. It indicates *degrees of likelihood of the presence* of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. Block group data may under- or over-represent the presence of these localized communities. For instance, in the large block groups in sparsely populated regions of the state, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the moderate potential category draws a wide net for potential environmental justice populations. As discussed in Appendix D, the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. Before FirstNet deploys projects, additional site-specific analyses to identify specific, localized environmental justice populations may be warranted. Such analyses could tier-off the methodology of this PEIS.

This map also does not indicate whether FirstNet projects would have actual impacts on environmental justice populations. An environmental justice effect on minority or low-income populations only occurs if the effect is harmful, significant (according to NEPA criteria), and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (CEQ, 1997). The Environmental Consequences section (Section 18.2) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

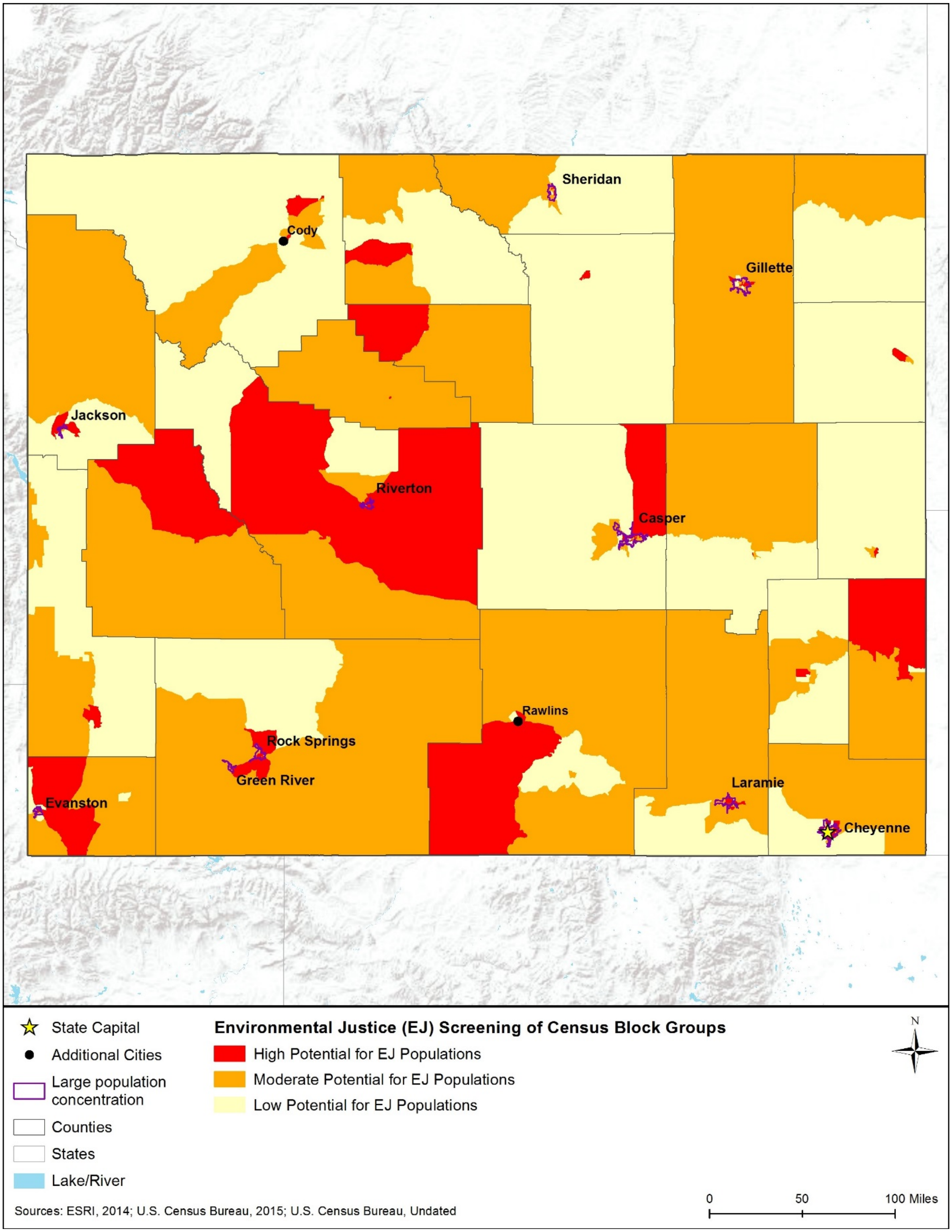


Figure 18.1.10-1: Potential for Environmental Justice Populations in Wyoming, 2009–2013

18.1.11. Cultural Resources

18.1.11.1. Definition of Resource

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

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

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

- Statutory language and implementing regulations for Section 106 of the NHPA, as amended, formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- Statutory language and implementing regulations for the Archaeological Resources Protection Act of 1979 (ARPA), 16 U.S.C. 470cc(c) and 43 CFR 7.3(a);
- Statutory language and implementing regulations for the Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3001(3)(D) and 43 CFR 10.2(d);
- NPS's program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources; and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

18.1.11.2. 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, such as the NHPA (detailed in Section 1.8, Overview of Relevant Federal Laws and Executive Orders), the American Indian Religious Freedom Act, ARPA, and NAGPRA. Appendix C, Environmental Laws and Regulations, summarizes these pertinent federal laws.

Wyoming has laws and state regulations that are similar to the NHPA (refer to Table 18.1.11-1). However, federal regulations supersede these laws and regulations. While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations.

Table 18.1.11-1: Relevant Wyoming Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Wyoming Antiquities Act of 1935 (W.S. 35-1-114 to 116)	Wyoming State Historic Preservation Office (SHPO)	This Regulation mirrors the NHPA for actions on state lands, requiring agencies to consult with SHPO regarding potential impacts to historic properties.

18.1.11.3. Cultural Setting

Human beings have inhabited Wyoming for some 15,000 years (Haynes, Johnson and Stafford 1999, Pauketat 2012, Davis 2010). The majority of the state's early human habitation evidence comes from the study of archeological sites of pre-European contact and historic populations. In addition to the hundreds of archaeological sites listed in the state's inventory, there are 65 archaeological site listed on the NRHP: 26 are historic, 37 are prehistoric, and 2 have both historical and prehistoric provenance (NPS, 2014e).

Archaeologists typically divide large study areas into regions. As shown in Figure 18.1.3-1, Wyoming occupies two physiographic regions, Interior Plains and Laurentian Upland, each of which is further subdivided into one physiographic province. The Laurentian Upland region contains the Superior Upland province and spans the nearly the entire northern area of the state except for a small parcel to the west. The Interior Plains region contains the Central Lowland province and covers the majority of the state encompassing the entire eastern coast and most of the land westward.

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

The following sections provide additional detail about Wyoming' prehistoric periods (approximately 13000 B.C. - A.D. 1800) and the historic period since European contact in the 1700s. Section 18.1.11.4 presents an overview of the initial human habitation in Montana and the cultural development that occurred before European contact. Section 18.1.11.5 discusses the federally recognized American Indian tribes with a cultural affiliation to the state. Section 18.1.11.6 provides a current list of significant archaeological sites in Wyoming and tools that the state has developed to ensure their preservation. Section 18.1.11.7 document the historic context of the state since European contact, and Section 18.1.11.8 summarizes the architectural context of the state during the historic period.

18.1.11.4. Prehistoric Setting

Archaeologists divide Wyoming' prehistoric past into three periods: The Early Prehistoric Period (13000 – 5500 B.C.), Middle Prehistoric Period (5500 B.C. - A.D. 200), and Late Prehistoric Period (A.D. 200 – 1800). Figure 18.1.11-1 shows a timeline representing these periods of early human habitation of present day Wyoming. It is important to note that there is potential for undiscovered archaeological remains representing every prehistoric period throughout the state. Evidence of human occupation is prevalent in each of Wyoming' physiographic regions. Due to advancements in techniques and associating artifacts discovered with similar ones previously assigned to a particular range of the archaeological record, the periods associated with a particular time in North American human development continue to become increasingly accurate (Pauketat, 2012; Haynes, Donahue, Jull, & Zabel, 1984; Haynes, Johnson, & Stafford, 1999).

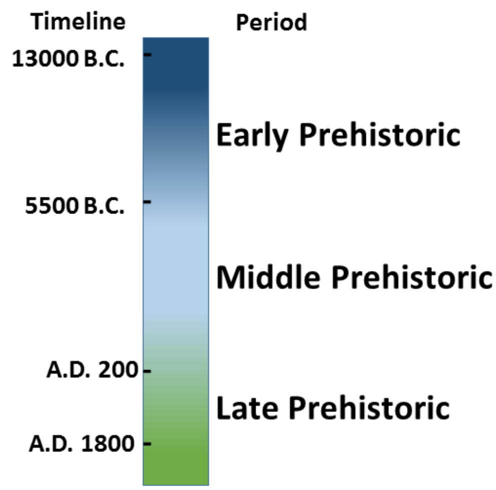


Figure 18.1.11-1: Timeline of Prehistoric Human Occupation

Sources: (Wyoming Archaeological Society, 2015) (Institute of Maritime History, 2015)

Early Prehistoric (13000 - 5500 B.C.)

The Paleoindian Period represents the earliest human habitation Wyoming, The earliest people to occupy the state were small groups of nomadic hunters and gatherers that used chipped-stone tools, including the “fluted javelin head” arrow and spear points, also referred to as the Clovis fluted point. Studies show that that such technology was prevalent in northeastern Asia, the Arabian Peninsula and Spain prior to human arrival into North America (Charpentier & Inizan, 2002).

Most of the oldest known evidence of human settlement in Wyoming are attributed to the discovery of fluted points found in surface and shallow deposits throughout the state. Archaeologists hypothesize that the people of this period ranged across the state in small bands that followed migratory big game animals. Giant bison was the predominate large animal that was hunted as opposed to mammoth, as in other parts of North America. Early Paleoindian settlers used the Clovis fluted point technology to hunt this large game. These bands established seasonal camps, some of which likely became permanent settlements. It is assumed that they were related to people who migrated to North America via a land bridge at the Bering Strait during the latter part of the last ice age (Late Pleistocene epoch).

Around ten to seven thousand years ago, there was gradual warming trend in this region, and the Folsom culture replaced the Clovis culture. The Folsom culture had more advanced methods for hunting bison, which lead to overhunting in the region. As hypothesized, the sophisticated hunting methods along with the climatological changes that were occurring at the time may have led to the distinction of the gradual extinction of the mammoth and other large animals (Manitoba Archaeological Society, 1998).

Middle Prehistoric (5,500 B.C. - A.D. 200)

The climate had changed to a desert-like condition by around 5,000 to 2,000 B.C. Along with temperature increase, there was a shift in the economy of the culture. A diversification in the subsistence patterns of the people in response to this new dryer climate was beginning to take hold during this period. They could no longer rely on the 'big game" hunting practices for survival, due to the decline in species. Instead, they shifted to subsistence pattern based on foraging for plants and hunting for small game. The people hunted larger game such as antelope, deer, and the occasional bison whenever they could. Archaeologists hypothesize that this led what is known as communal bison hunts, where large groups of people worked together to run herds of bison over a cliff to kill them. The hunting implements of this period were more crudely manufactured that during the Clovis and Folsom. More grinding slabs and plant processing tools are attributed to this period than in the ones that preceded. Indications of fabricated shelters have been discovered by the identification of "tipi rings" that were used to keep their potable habitats in place (Niven and Hill 1998).

During the Archaic period, the people built earthen houses. They built pits inside the houses where food was stored (Larson 1997). The people collected seeds that they grinded to make a form of bread that was cooked over an open pit (Smith, Seeds, Weeds, and Prehistoric Hunters and Gatherers: The Plant Macrofossil Evidence from Southwest Wyoming 1988).

Late Prehistoric (A.D. 200 - 1800)

The climate of the Late Prehistoric Period was much like the climate is today in Wyoming. Ceramics became more common, which is an indication of a more sedentary lifestyle. Horticulture practices were becoming the predominant way of life (Miller, Waitkus and Eckles 1987, Frison 1993, Husted and Edgar 2002).

18.1.11.5. Federally Recognized Tribes of Wyoming

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are 2 federally recognized tribes in Wyoming: the Arapaho Tribe of the Wind River Reservation and the Shoshone Tribe of the Wind River reservation (National Conference of State Legislators, 2015). The location of federally recognized tribes are shown in Figure 18.1.11-2. There are several other tribes depicted on the figure below that once lived in Wyoming, but do not retain federal reservation or trust lands here any longer.

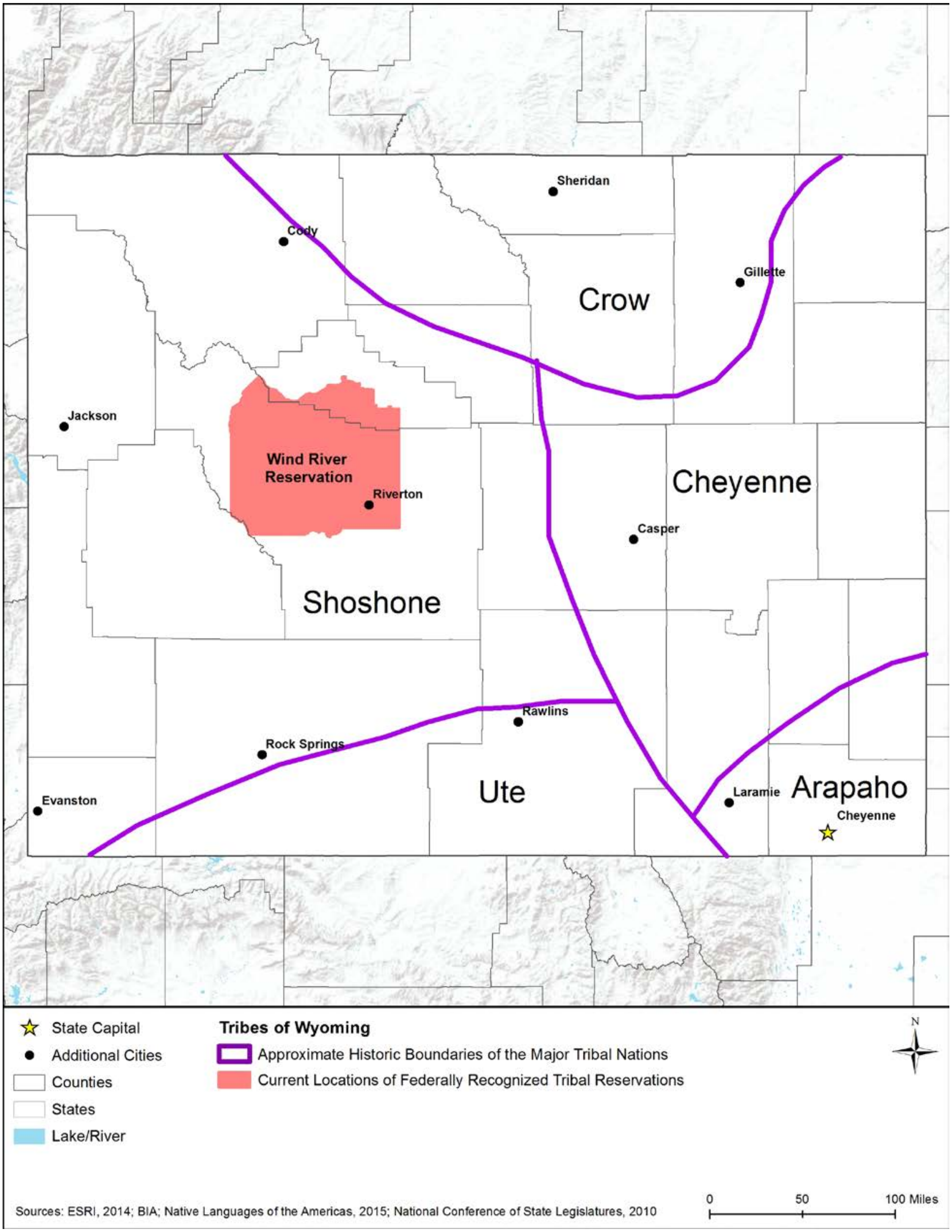


Figure 18.1.11-2: Approximate Historic Boundaries of Tribes in Wyoming

18.1.11.6. Significant Archaeological Sites of Wyoming

As previously mentioned in Section 18.1.11.3, there are 65 archaeological sites in Wyoming listed on the NRHP. Table 18.1.11-2 lists the names of the sites, the city to which they are closest, and the 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 at http://www.nps.gov/nr/ (NPS, 2014f).

Wyoming State Cultural Resources Database and Tools

Wyoming State Historic Preservation Office

The Wyoming State historic Preservation Office Historical Society (SHPO) acts as the State Historic Preservation Office (SHPO) for Wyoming. The SHPO numerous resources on their website (http://wyoshpo.state.wy.us/) including public access to multiple online collections, historical context reports, and a list of historical professionals in the state. The Wyoming Cultural Resource Information System (WYCRIS) which contains two GIS databases, is accessible to qualified professionals in the fields of history or archaeology. User requests forms can be downloaded from the WYCRIS page (Wyoming State Parks & Cultural Resources, 2015).

Wyoming Archaeology

Wyoming Archaeology is website (www.wyomingarchaeology.org) sponsored by two archaeological associations, the Wyoming Association of Professional Archaeologists and the Wyoming Archaeological Society. The purpose of the collaboration project is to facilitate the dissemination of preservation information to the public. The site contains upcoming events, news, and free access to the society's journal, The Wyoming Archaeologist (Wyoming Archaeological Society, 2015).

Table 18.1.11-2: Archaeological Sites on the National Register of Historic Places in Wyoming

Closest City	Site Name	Type of Site
Arminto	Archeological Site No. 48NA83	Historic - Aboriginal, Prehistoric
Baggs	Powder Wash Archeological District	Prehistoric
Big Piney	Archeological Site No. 48SU354	Prehistoric
Big Piney	Wardell Buffalo Trap	Prehistoric
Casper	Casper Buffalo Trap	Prehistoric
Casper	Fort Caspar	Historic, Military
Casper	Fort Caspar (Boundary Increase)	Historic, Military
City Unavailable	Antelope Creek Crossing (48CO171 and 48CO165)	Historic
City Unavailable	Holdup Hollow Segment, Bozeman Trail (48CO165)	Historic

Closest City	Site Name	Type of Site
City Unavailable	Ross Flat Segment, Bozeman Trail (48C0165)	Historic
City Unavailable	Stinking Water Gulch Segment, Bozeman Trail (48CO165)	Historic
City Unavailable	Lake DeSmet Segment, Bozeman Trail	Historic
City Unavailable	Trabing Station--Crazy Woman Crossing	Historic - Aboriginal, Military
Cody	Dead Indian Campsite	Historic, Historic - Aboriginal
Cody	Horner Site	Prehistoric
Cody	Mummy Cave	Historic
Daniel	Upper Green River Rendezvous Site	Prehistoric
Dubois	High Rise Village	Prehistoric
Dubois	Lookingbill, Helen, Site	Prehistoric
Dubois	Torrey Lake Petroglyph District	Prehistoric
Eden	Finley Site, The	Prehistoric
Elk Mountain	Allen, Garrett, Prehistoric Site	Prehistoric
Evanston	Bridger Antelope Trap	Historic - Aboriginal
Fort Bridger	Fort Bridger	Historic, Military
Ft. Washakie	Wind River Agency Blockhouse	Historic - Aboriginal, Military
Glenrock	Glenrock Buffalo Jump	Prehistoric
Glenrock	Sage Creek Station (48CO104)	Historic
Grass Creek	Legend Rock Petroglyph Site	Prehistoric
Greybull	Bear Creek Ranch Medicine Wheel (48BH48)	Prehistoric
Hadsell Cabin	Arapahoeand Lost Creek Site (48SW4882)	Prehistoric
Hartville	Patten Creek Site (48PL68)	Prehistoric
Honeycomb Buttes	Decker, Dean, Site (48FR916; 48SW541)	Prehistoric
Hyattville	Medicine Lodge Creek Site	Prehistoric
Hyattville	Paint Rock Canyon Archeological Landscape District	Prehistoric
Kane	Medicine Wheel--Medicine Mountain	Historic, Prehistoric
La Barge	La Barge Bluffs Petroglyphs	Prehistoric
Medicine Bow	Muddy Creek Archeological Complex	Prehistoric
Moneta	Castle Gardens Petroglyph Site	Prehistoric
Moorcroft	Arch Creek Petroglyphs (48CK41)	Prehistoric
Moorcroft	McKean Archeological Site (48CK7)	Prehistoric
Mule Creek	Agate Basin Site	Prehistoric
Orpha	Fort Fetterman	Military
Pine Tree Junction	Nine Mile Segment, Bozeman Trail (48CA264)	Historic
Pinedale	Fort Bonneville	Historic, Military
Pinedale	Trappers Point Site	Prehistoric
Piney	Basin Oil Field Tipi Rings (48CA1667)	Prehistoric
Piney	Bishop Road Site (48CA1612)	Prehistoric
Rawlins	Midway Station Site	Historic
Rawlins	Pine Grove Station Site	Historic, Military
Rawlins	Sage Creek Station Site	Historic, Military

Closest City	Site Name	Type of Site
Rawlins	Washakie Station Site	Historic - Aboriginal, Military
Rock Springs	Dug Springs Station Site	Historic, Military
Rock Springs	Laclede Station Ruin	Historic, Military
Shell	Black Mountain Archeological District (48BH900/902/1064/106 7/1126/1127/1128/1129)	Prehistoric
Shell	Black Mountain Archeological District (Boundary Increase)	Prehistoric
Shell	Hanson Site	Prehistoric
Sheridan	Big Goose Creek Buffalo Jump	Prehistoric
South Superior	Natural Corrals Archeological Site (48SW336)	Historic - Aboriginal, Prehistoric
Split Rock Ranch	Split Rock Prehistoric Site (48FR1484)	Prehistoric
Story	Fort Phil Kearny and Associated Sites	Historic - Aboriginal, Military
Stratton Rim	Green Mountain Arrow Site (48FR96)	Prehistoric
Sundance	Vore Buffalo Jump	Prehistoric
Sussex	Powder River Station--Powder River Crossing (48JO134 and 48JO801)	Historic
Verne	Triangulation Point Draw Site District (48UT114; 48UT377; 48UT392; 48UT440)	Prehistoric
Wamsutter	Duck Lake Station Site	Historic, Military
Westvaco	Eldon--Wall Terrace Site (48SW4320)	Prehistoric

Source: (NPS, 2015p)

18.1.11.7. Historic Context

Though Spanish colonial artifacts have been found in several places in the state, they are believed to have arrived through tribal trading with places further south such as New Mexico. The first European explorers that are believed to have entered the northeast part of the state are the two sons, Francois and Louis-Joseph, of the famed French Canadian explorer, Pierre Gaultier de Varennes, Sieur de la Verendrye, in 1743. In 1807, a former member of the Lewis and Clark expedition, John Colter, became the first European-American to explore what is now Yellowstone National Park and the Teton Range. Trappers worked in the area until around 1840. Their exploration of the area would later aid in the establishment of the Oregon Trail, as well as other historic trails. Remnants of these trails can still be seen on the landscape today. While travelers passed through Wyoming in great numbers during the middle of the 19th century, settlement was rare due to the inhospitable landscape (Wyoming State Historic Preservation Office, 2015).

Wyoming was included as a part of the Dakota Territory in 1864, but separated and formed the Wyoming Territory in 1868. In 1869, Wyoming became the first territory or state in the nation to grant women the right to vote. The Union Pacific Railroad was instrumental in the settlement of the state, and “Cheyenne, Laramie, Rawlins, Rock Springs, Green River, and Evanston were all established because of the railroad’s route through southern Wyoming” (Rochester Academy of Science, 2015). Coal was mined in Wyoming, but ranching became important as well after the establishment of the railroad allowed for livestock to be shipped east. Northern Wyoming was not settled until later due to the presence of Indians, while the Bighorn Basin was not settled until the late 1890s due to a lack of water. In 1905, the Buffalo Bill Dam was built to address the water situation (Wyoming State Historic Preservation Office, 2015). On July 10, 1890, Wyoming became the 44th state to join the Union.

The passage of the "the 320-acre Homestead Act in 1909, promotion of dry-farming experiments, and favorable moisture conditions for a number of years" increased settlement during the early 20th century; however, many left after failing to establish successful farms (Rochester Academy of Science, 2015). While coal had been mined since the middle of the 19th century, oil was discovered in the early 20th century. Wyoming suffered significantly during the Great Depression, as oil prices fell, but rebounded during World War II (WWII) (Wyoming State Historic Preservation Office, 2015).

Wyoming has 538 NRHP listed sites, as well as 24 NHLs. Wyoming does not contain any National Heritage Areas (NPS, 2014f). Figure 18.1.11-3 shows the location NRHP sites within Wyoming.[134]

18.1.11.8. Architectural Context

Early evidence of non-indigenous activity in Wyoming includes remnants of roads and trails. The Oregon Trail is perhaps most well-known, and its wagon ruts are still visible today (Wyoming State Historic Preservation Office, 2015). Early structures were built of logs, tents, or into hillsides as dugout houses. "False-front architecture" was common in more permanent settlements (Starr, 1992). False-front structures were hastily constructed buildings of logs, tents, or wood framing that featured an oversized, flat, wood-framed façade meant to give the appearance of an urban dwelling and provide room for signage. Depending on the success of the settlement, the building itself would eventually be upgraded or replaced. If the settlement failed, buildings were abandoned (Heath, 1989). Examples of false-front architecture can still be seen today, primarily in smaller towns (Starr, 1992).

Wyoming has many agricultural resources of varying types and styles. These include farm houses, barns, silos, and other types of outbuildings. Structures were built of wood, stone, or compressed earth depending on the availably of materials. Building appearance and layout were greatly affected by the ethnicity of the builder, particularly early on when settlement was initially occurring. Wealthy cattle farmers constructed impressive houses that displayed styles popular during the time, such as Gothic Revival and piece-sur-piece log construction. Many of these large cattle ranch houses were constructed during the open range period, barbed wire fences were later added to enclose land as ranching practices changed. "The landscape of north, east, and central Wyoming is littered with the remnants of failed dryland farms" (Starr, 1992).

[134] See Section 18.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

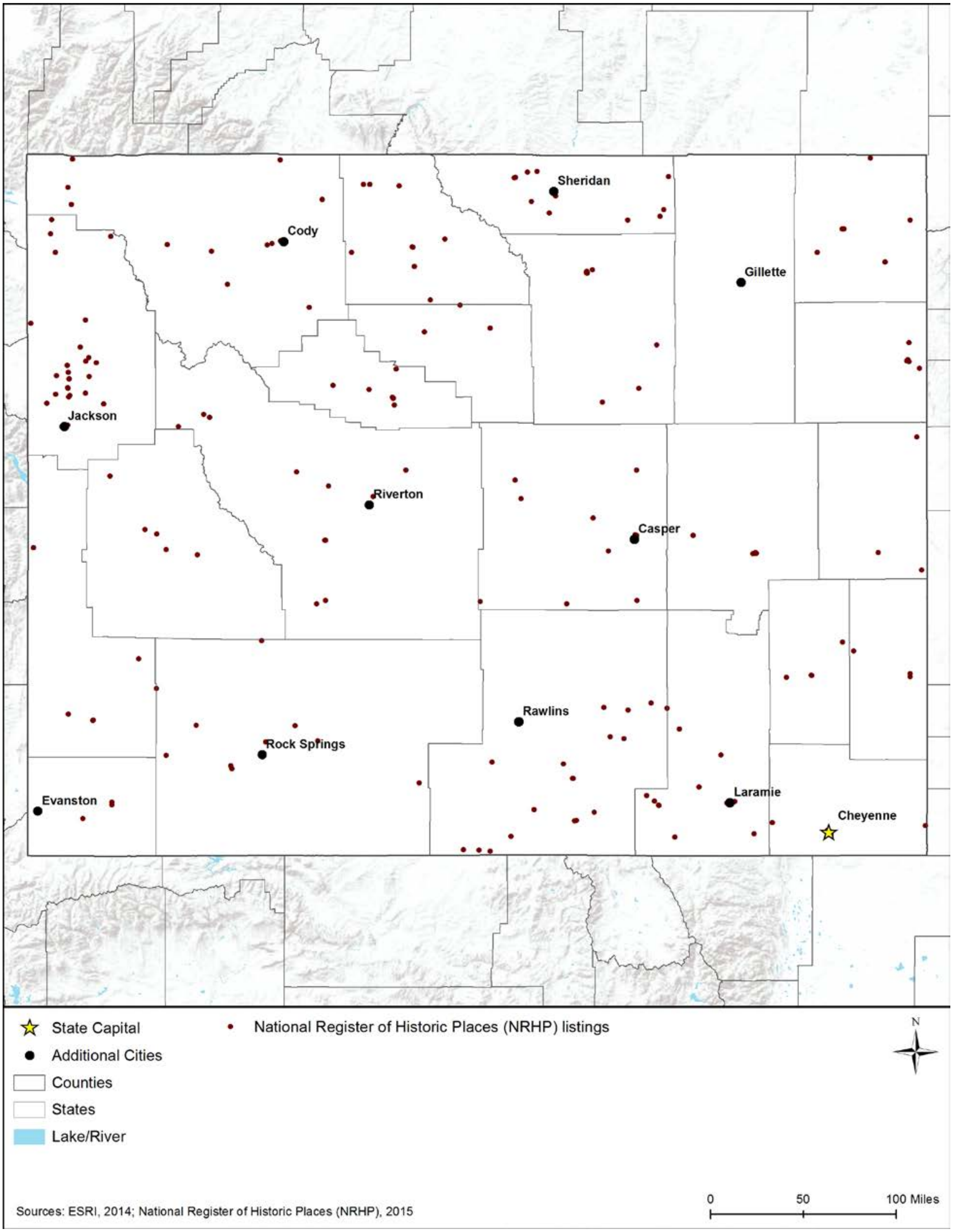


Figure 18.1.11-3: National Heritage Area and National Register of Historic Sites in Wyoming

The railroad was instrumental in the growth of Wyoming, with most early towns beginning as railroad settlements. Depots, railroad hotels, train yards, and historic rail lines are common. Older buildings within the town are generally located closest to rail lines, as this was preferable real estate. As mentioned, early commercial architecture was often false-front, but later replaced by more permanent structures. The rail road also allowed for architectural components to be brought from the east, such as metal building components, bricks, terra cotta, etc. Schools were seen as important facilities and varied in size depending on the settlement they were supporting. Libraries were important as well, with Andrew Carnegie-funded libraries serving as a great example. Industrial architecture is also common on the landscape and ranges from oil refineries, to charcoal kilns, to company towns associated with mining activities (Starr, 1992).

Government constructed buildings are common and often prominent. Prisons are an example of these, as are courthouses, town halls, and post offices. Post offices are often building in the neoclassical style, while other government styles used include Spanish Revival, Beaux Arts, and others. During the Great Depression, the Civilian Conservation Corps (CCC) constructed a number of public and community buildings. During the 19th century, many forts were constructed, some of which remain today and include barracks, storage facilities, stores, hospitals, and barns (Starr, 1992).

Residential housing in Wyoming follows basic national trends, with Victorian Era house styles like Queen Anne, Shingle, and Folk Victorian being built during the late 19th century. These were largely built by wealthier residents, with more vernacular types and styles being built by lower income residents. The 20th century brought about styles like Colonial Revival, Spanish Revival, and Neoclassical. Popular housing types include shotgun houses earlier on, with bungalows and Prairie style houses gaining popularity after World War I (WWI), minimal traditional houses following WWII, and ranch houses during the Midcentury Era. In multifamily housing, Art Deco was popular during the 1920s and 1930s. Company town housing was also built and can often times be identified by the mass repetition of a single house form within a neighborhood (Starr, 1992).

Figure 18.1.11-3: Representative Architectural Styles of Wyoming

Top Left– Union Pacific Passenger Station (Cheyenne, WY) – (Historic American Building Survey, 1933a)
Bottom Left – Smith-Sherlock Store (South Pass City, WY) – (Historic American Building Survey, 1933b)
Top Right – Four Mile Bridge (Thermopolis, WY) – (Historic American Engineering Record, 1968)
Middle Right – Ewing T. Kerr Federal Building (Casper, WY) – (Highsmith, 2009)
Bottom Right – Dunlap Ranch (Gillette, WY) – (Historic American Building Survey, 1933c)

18.1.12. Air Quality

18.1.12.1. 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[135] 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)[136] or micrograms per cubic meter (μg/m^3) determined over various periods of time (averaging time).[137] This section discusses the existing

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

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

[137] 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, 2015p)

air quality in Wyoming. The USEPA designates areas within the United States as attainment,[138] nonattainment,[139] maintenance,[140] or unclassifiable[141] depending on the concentration of air pollution relative to ambient air quality standards. Information is presented regarding national and state ambient air quality standards and nonattainment areas that would be potentially more sensitive to impacts from implementation of the Proposed Action or alternatives.

18.1.12.2. Specific Regulatory Considerations

National and State Ambient Air Quality Standards

The Clean Air Act (CAA) establishes National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: Carbon monoxide (CO), lead, oxides of nitrogen (NO_X), particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), and oxides of sulfur (SO_X). The NAAQS establish various standards, either primary[142] or secondary,[143] 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, 2016d) . HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. Appendix E presents a list of federally regulated HAPs.

In conjunction with the federal NAAQS, Wyoming maintains its own air quality standards, the Wyoming Ambient Air Quality Standards. Table 18.1.12-1 presents an overview of the state standards as defined by the WDEQ, Air Quality Division.

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

[139] 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, 2015q).

[140] 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, 2015q)

[141] 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, 2015q)

[142] Primary standard: The primary standard is set to provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly. (USEPA, 2014a)

[143] Secondary standards: The secondary standard is set to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. (USEPA, 2014a)

Table 18.1.12-1: Wyoming Ambient Air Quality Standards

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		µg/m³	ppm	µg/m³	ppm	
CO	8-hour	10,000	9	-	-	Maximum. Not to be exceeded more than once per year.
	1-hour	40,000	35	-	-	
Lead	3-month	0.15	-	Same as Primary		Annual 4th highest daily maximum.
NO_X	Annual	-	0.053	Same as Primary		-
	1-hour	-	0.10	-	-	-
PM_{10}	Annual	50	-	-	-	Annual arithmetic mean.
	24-hour	150	-	-	-	Not to be exceeded more than once per year.
$PM_{2.5}$	Annual	15	-	Same as Primary		Annual arithmetic mean.
	24-hour	35	-	Same as Primary		98th percentile of the 24-hour average.
O_3	8-hour	-	0.075	Same as Primary		3-year average of the annual fourth-highest daily maximum.
SO_X	3-hour	-	-	-	0.5	Not to be exceeded more than once per calendar year.
	1-hour	-	0.075	-	-	99th percentile of the daily maximum.
H_2S	30-minute	70	-	-	-	Not to be exceeded more than two times per year.
	30-minute	40	-	-	-	Not to be exceeded more than two times in any five consecutive days.
Sulfur Trioxide (SO_3)	Annual	250 µg/m²/day				Maximum annual average.
	30-day	500 µg/m²/day				Maximum 30-day value.
Fluorides (Statewide)	30-day	0.4	-	-	-	Maximum allowable concentration, measured as hydrogen fluoride.
	7-day	0.5	-	-	-	
	24-hour	1.8	-	-	-	
	12-hour	3.0	-	-	-	
Fluorides (Regional)[a]	30-day	1.2	-	-	-	Maximum allowable concentration, measured as hydrogen fluoride.
	7-day	1.8	-	-	-	
	24-hour	4.0	-	-	-	
	12-hour	10.0	-	-	-	
Fluorides (in forage)	Annual	-	30	-	-	Fluoride in forage for animal consumption, measured as fluorine by dry weight.
	60-day	-	60	-	-	
	30-day	-	80	-	-	

Source: (WDEQ, 2015j)

[a] "The Regional Standard applies to the area encompassing the following lands in Sweetwater County, Wyoming:

- T19N R104W, E1/2 Section 31 & Sections 32, 33, 34, 35, 36;
- T19N R103W, Section 31;
- T18N R105W, S1/2 Section 1 & Sections 12, 13, 24, 25, 35, 36;
- T18N R104W, All Sections 1 through 36;
- T18N R103W, Sections 6, 7, 18, 19, 30, 31, 32, 33;
- T17N R105W, Sections 1, 2, 11, 12, 13, 14, 23, 24, 25, 26;
- T17N R104W, Sections 1 through 30; and
- T17N R103W, Sections 4, 5, 6, 7, 8, 9, 16, 17, 18, 19, 20, 21, 28, 29, 30"

Title V Operating Permits/State Operating Permits

Wyoming 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, 2015i). The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (USEPA, 2015i). Wyoming Air Quality Standards and Regulations (WAQSR) Chapter 6, Section 3 describes the applicability of Title V operating permits. Wyoming 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 18.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 18.1.12-2: Major Air Pollutant Source Thresholds

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

Source: (USEPA, 2014c)

Exempt Activities

The following activities are exempt from obtaining approval to construct or modify:

- "…Fuel burning equipment other than a smokehouse generator which has a heat input of not more than 25 million British thermal units (BTU) per hour (6.25 billion gm-cal/hr) and burns only gaseous fuel containing not more than 20 grains total sulfur per 100 std. ft^3; has a heat input of not more than 10 million BTU/hr (2.5 billion gm-cal/hr) and burns any other fuel.
- Mobile internal combustion engines.
- Approval to construct or modify shall not be required for:
  - The installation or alteration of an air pollutant detector, air pollutants recorder, combustion controller, or combustion shutoff.
  - Air conditioning or ventilating systems not designed to remove air pollutants generated by or released from equipment.
  - Fuel burning equipment other than a smokehouse generator which has a heat input of not more than 25 million BTU per hour (6.25 billion gm-cal/hr) and burns only gaseous fuel containing not more than 20 grains total sulfur per 100 std. ft3; has a heat input of not more than 10 million BTU/hr (2.5 billion gm-cal/hr) and burns any other fuel.
  - Mobile internal combustion engines.
  - Laboratory equipment used exclusively for chemical or physical analyses.
  - The installation of air pollution control equipment which is not a part of a project which requires a construction or modification permit under Chapter 6, Section 2 or 4 of these regulations.
  - Gasoline storage tanks at retail establishments.
  - Such other minor sources which the Administrator determines to be insignificant in both emission rate and ambient air quality impact.
  - …minor sources [that the Administrator of the Division of Air Quality] determines to be insignificant in both emission rate and ambient air quality impact…" (WDEQ, 2015k)

Temporary Emissions Sources Permits

Existing portable sources moving to new locations require a permit to operate. “However, a permit to construct is required for each new location that is a new source or facility and for each new or modified portable source or facility.” For new locations that “are not new sources or facilities,” WDEQ “may authorize the owner or operator [of portable sources or facilities] to utilize a ‘self issuance’ operating permit system.” (WDEQ, 2015k)

In the case of temporary, portable source operating permits, the WDEQ may also “issue a single permit authorizing emissions from similar operations by the same source owner or operator at multiple temporary locations. The operations must be temporary and involve at least one change of location during the term of the permit.” (WDEQ, 2015k)

State Preconstruction Permits

In accordance with WAQSR Chapter 6, Section 2(a)(i), “any person who plans to construct any new facility or source, modify any existing facility or source, or to engage in the use of which may cause the issuance of or an increase in the issuance of air contaminants into the air of this state shall obtain a construction permit from the state of Wyoming, Department of Environmental Quality before any actual work is begun on the facility.” (WDEQ, 2015k)

General Conformity

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

The estimated pollutant emissions are compared to *de minimis*[144] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 18.1.12-3. As a result, lower *de minimis* thresholds for Volatile Organic Compounds (VOC) and NO_X could apply depending on the attainment status of a county.

[144] de minimis: “USEPA states that “40 CFR 93 § 153 defines de minimis levels, that is, the minimum threshold for which a conformity determination must be performed, for various criteria pollutants in various areas.” (USEPA, 2016i)

Table 18.1.12-3: *De Minimis* Levels

Pollutant	Area Type	Tons per Year
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
	Other areas outside an Ozone Transport Region (OTR)	100
Ozone (NO_X)	Maintenance	100
Ozone (VOC)	Maintenance outside an OTR	100
CO, Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2)	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ (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 18.1.12-3 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 18.1.12-3 then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity[145], 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 Wyoming SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Wyoming's SIP is a conglomeration of

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

separate actions taken for each of the pollutants. All of Wyoming's SIP actions are codified under 40 CFR Part 52 Subpart ZZ. USEPA-approved SIP rules and regulations can be found through the Wyoming state website (http://soswy.state.wy.us/Rules/default.aspx).

18.1.12.3. Environmental Setting: Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Figure 18.1.12-1 and Table 18.1.12-4, below, present the nonattainment areas in Wyoming as of January 30, 2015. Table 18.1.12-4 contains a list of the counties and their respective current nonattainment status of each criteria pollutant. The year(s) listed in the table for each pollutant indicate the date(s) when USEPA promulgated an ambient air quality standard for that pollutant. Note certain pollutants have more than one standard in effect (e.g., PM_{10} and O_3). Unlike Table 18.1.12-4, Figure 18.1.12-1 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.

Air Quality Monitoring and Reporting

WDEQ Air Quality Division measures air pollutants at 34 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network (WDEQ, 2015l). Annual Wyoming State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. WDEQ reports real-time pollution levels of O_3, NO_2, PM_{10}, and $PM_{2.5}$ on their website, http://www.wyvisnet.com.

From 2009-2013, O_3 measurements exceeded the federal standard of 0.075 ppm 22 times in stations across Wyoming, and 19 of these occurred in Sublette County (WDEQ, 2015m). Through 2014, "all monitors are attaining [the] NAAQS" (WDEQ, 2015l).

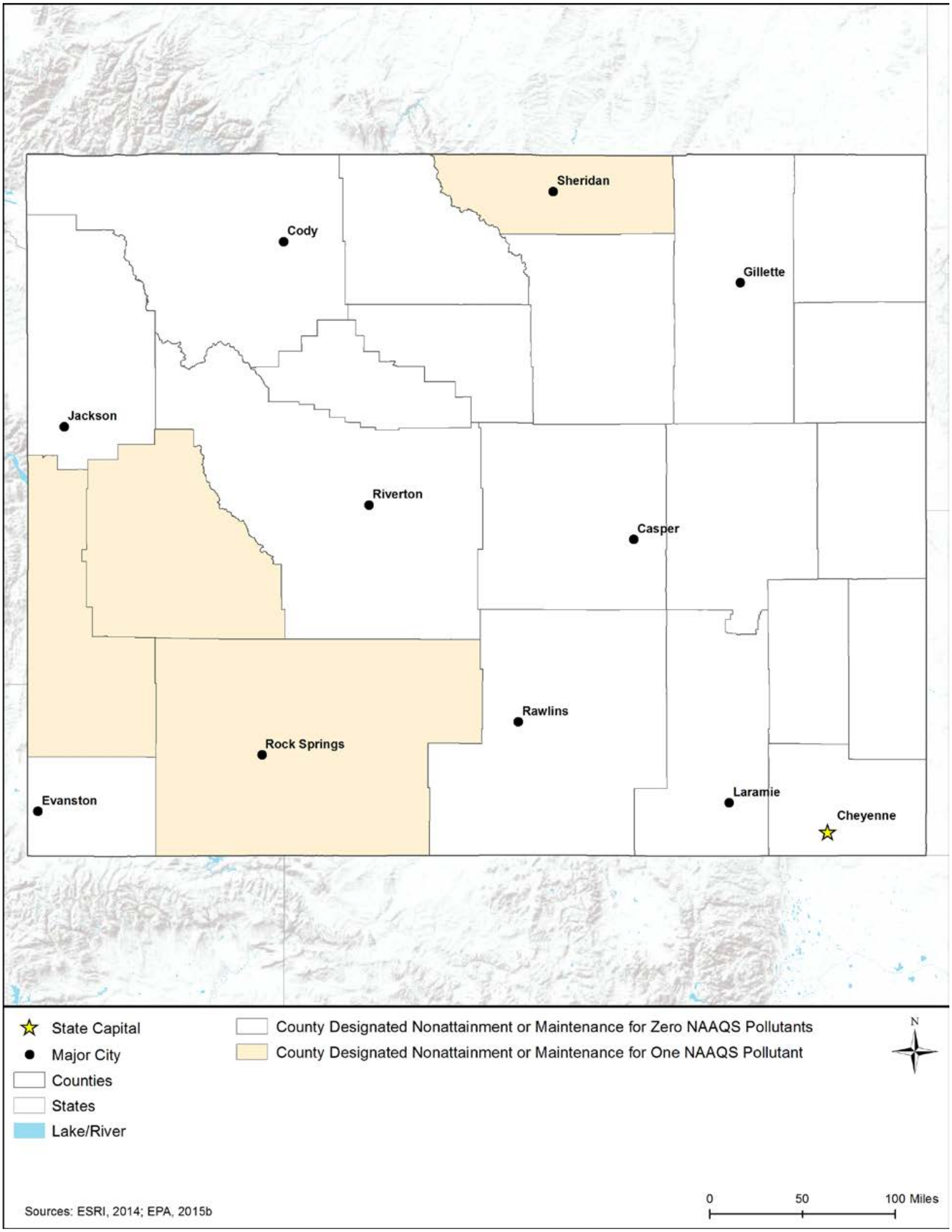


Figure 18.1.12-1: Nonattainment and Maintenance Counties in Wyoming

Table 18.1.12-4: Wyoming Nonattainment and Maintenance Areas by Pollutant Standard and County

	Pollutant[a] and Year USEPA Implemented Standard										
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$		O_3		SO_2	
County	**1971**	**1978**	**2008**	**1971**	**1987**	**1997**	**2006**	**1997**	**2008**	**1971**	**2010**
Lincoln									X-5		
Sheridan					X-4						
Sublette									X-5		
Sweetwater									X-5		

Source: (USEPA, 2015j)

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

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

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

PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. An air quality analysis is required for sources subject to PSD requirements and generally consists of using a dispersion model to evaluate emission impacts to the area. "Historically, the EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II

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

modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 50 kilometers[147] (the normal useful range of EPA-approved Gaussian plume models)" (USEPA, 1992).

Wyoming contains seven Federal Class I areas; all other land within the state is classified as Class II (USEPA, 2012a). 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). Montana, Colorado, and South Dakota also have Class I areas where the 100-kilometer buffer intersects a few Wyoming counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office.

Figure 18.1.12-2 provides a map of Wyoming 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 18.1.12-2 corresponds to the numbers and Class I areas listed in Table 18.1.12-5.

Table 18.1.12-5: Relevant Federal Class I Areas

#[a]	Area	Acreage	State
1	Yellowstone National Park	2,219,737	WY
2	Grand Teton National Park	305,504	WY
3	Washakie Wilderness Area	686,584	WY
4	Teton Wilderness Area	557,311	WY
5	North Absaroka Wilderness Area	351,104	WY
6	Fitzpatrick Wilderness Area	191,103	WY
7	Bridger Wilderness Area	392,160	WY
8	Red Rock Lakes Wilderness Area	32,350	MT
9	Rocky Mountain National Park	263,138	CO
10	Rawah Wilderness Area	26,674	CO
11	Mount Zirkel Wilderness Area	72,472	CO
12	Wind Cave National Park	28,060	SD

Source: (USEPA, 2012a)

[a] The numbers correspond to the shaded regions in Figure 18.1.12-2.

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

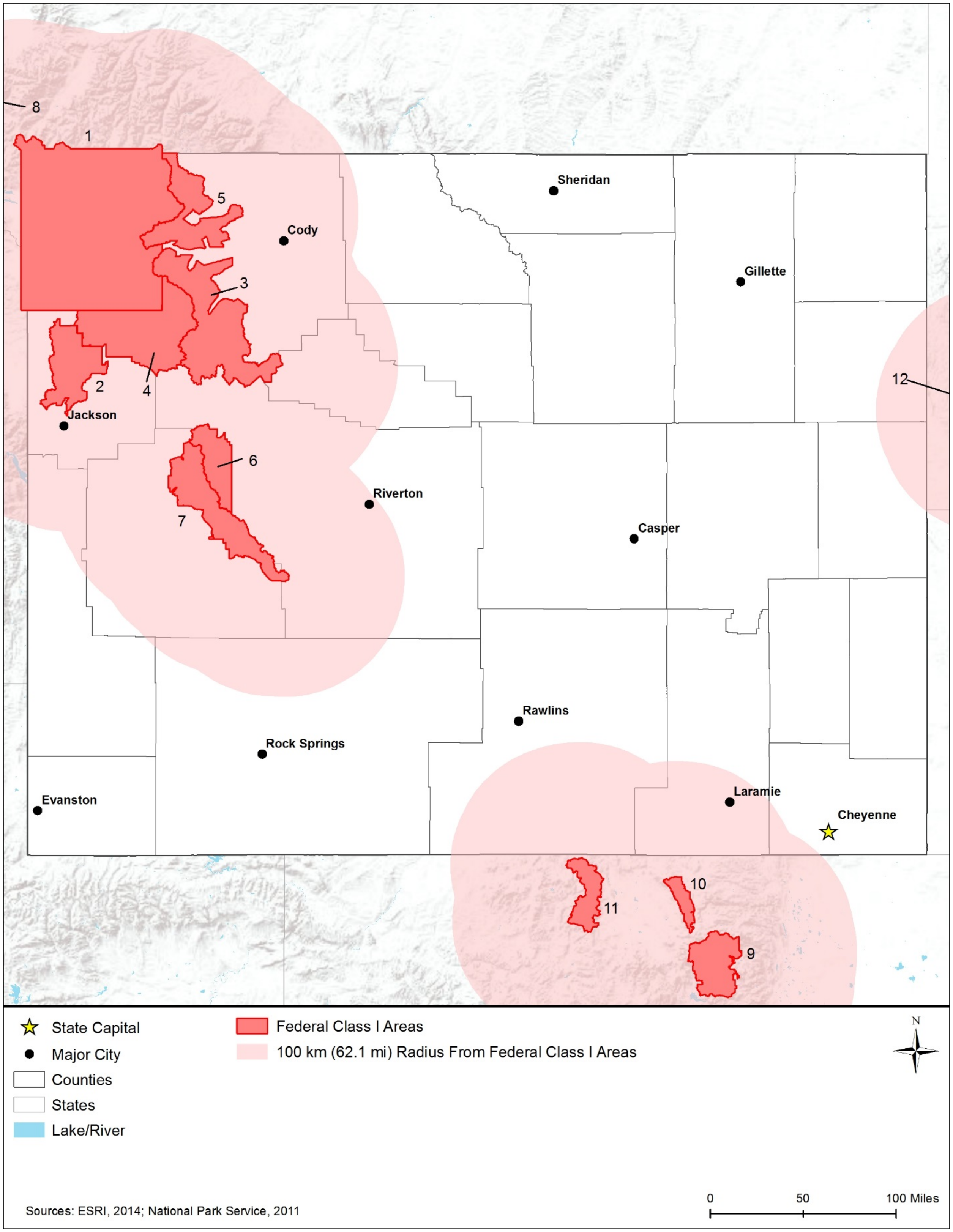


Figure 18.1.12-2: Federal Class I Areas with Implications for Wyoming

18.1.13. Noise

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

18.1.13.1. Definition of the Resource

Noise is a form of sound caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 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, 2016a). The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound (Federal Transit Authority, 2006). The normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 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, 2016a).

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

- The total sound energy radiated by a source, usually reported as a sound power level.
- The actual air pressure changes experienced at a particular location, usually measured as a sound pressure level (SPL) (the frequency characteristics and SPL combine to determine the loudness of a sound at a particular location).
- The duration of a sound.
- The changes in frequency characteristics or pressure levels through time.

Figure 18.1.13-1 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.

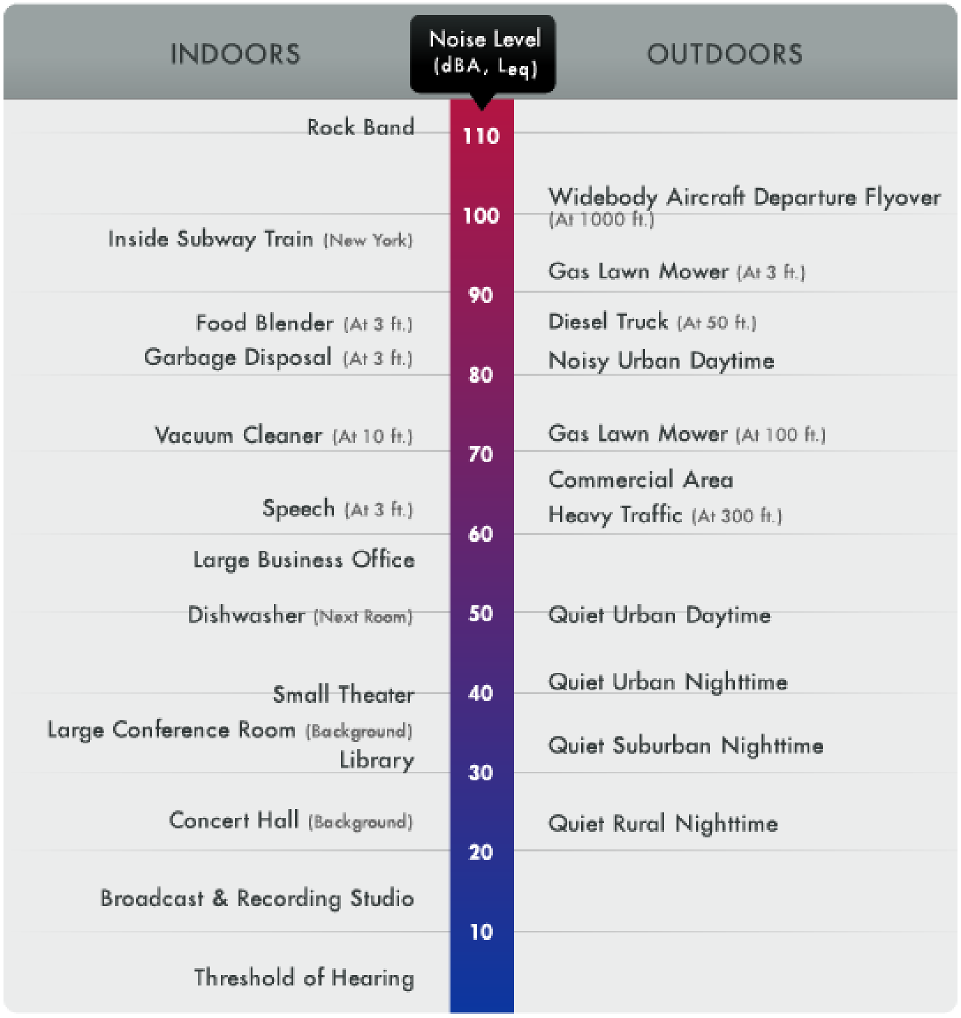


Figure 18.1.13-1: Sound Levels of Typical Sounds

Leq: Equivalent Continuous Sound Level.
Source: (Sacramento County Airport System, 2015)
Prepared by: Booz Allen Hamilton

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

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

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

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

18.1.13.2. 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.

Wyoming has several statewide noise regulations written into their state statutes. They mainly apply to motor vehicle functions such as horns and mufflers. Table 18.1.13-1 provides a brief summary of these regulations.

Table 18.1.13-1: Relevant Wyoming Noise Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Wyoming Statute Title 31, Chapter 5 – Regulation of Traffic on Highways (31-5-952)	Wyoming Department of Transportation	Establishes requirements and parameters for warning devices on motor vehicles operating on highways.
Wyoming Statute Title 31, Chapter 5 – Regulation of Traffic on Highways (31-5-953)	Wyoming Department of Transportation	Requires vehicles to operate with a muffler.

Source: (Wyoming Legislature, 2015)

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. Larger cities and towns, such as Cheyenne, Casper, and Laramie 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).

18.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in Wyoming varies widely based on the area and environment of the area. The population of Wyoming can choose to live and interact in areas that are large cities, rural or suburban communities, small towns, and national and state parks. Figure 18.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Wyoming may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Wyoming. As such, this section describes the areas where the population of Wyoming 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). The areas that are likely to have the highest ambient noise levels in the state are Cheyenne, Casper, and Laramie, as these are the most populated areas (U.S. Census Bureau, 2012) (U.S. Census Bureau, 2015b) (U.S. Census Bureau, 2015f).
- **Airports**: Areas surrounding airports tend to have higher noise levels due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2007). However, commercial aircraft are most likely to emit noise levels between 50 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports is in proximity to urban communities resulting in noise exposures from aircraft operations (arrivals/departures) to surrounding areas at higher levels and with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In Wyoming, Jackson Hole Airport (JAC) has annual operations of more than 26,000 flights (FAA, 2015j). These operations result in increased ambient noise levels in the surrounding communities. See Section 18.1.7, Land Use, Recreation, and Airspace, and Table 18.1.7-7 for more information about airports in the state.
- **Highways**: Communities near major highways also experience higher than average noise levels when compared to areas that are not in close proximity to a highway (FHWA, 2015d). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living near those traffic corridors. Major highways tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA, 2015d). See Section 18.1.1, Infrastructure, and Figure 18.1.1-1 for more information about the major highways in the state.
- **Railways**: Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (Federal Transit Authority, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (FRA, 2015b). Wyoming does not have any passenger rail service. However, there are several freight rail corridors (WYDOT, 2015d). BNSF operates a freight rail service from Cheyenne to Casper and Frannie. It also operates a section from Sheridan to Newcastle. Union Pacific Railroad operates freight rail service from Evanston to Laramie, Cheyenne, Yoder, and Shawnee. Both companies operate services from Donkey Creek Junction to Bridger Junction

(WYDOT, 2015d). See Section 18.1.1, Infrastructure, and Figure 18.1.1-1 for more information about rail corridors in the state.

- **National and State Parks:** The majority of national and state parks are likely to have lower than average ambient noise levels given their size and location in wilderness areas. National and state parks, historic areas, and monuments are protected areas to preserve these areas in their natural environment. These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014g). Wyoming has 2 National Parks and 6 National Natural Landmark (NPS, 2015q). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 18.1.8, Visual Resources, and Figure 18.1.8-2 for more information about national and state parks for Wyoming.

18.1.13.4. Sensitive Noise Receptors

Noise-sensitive receptors include residences, schools, medical facilities, places of worship, libraries, churches, nursing homes, concert halls, playgrounds, and parks. Sensitive noise receptors are typically areas where the intrusion of noise can disrupt the use of the environment. A quiet urban area usually has a typical noise level in the daytime of 50 dBA, and 40 dBA during the evening. Noise levels in remote wilderness and rural nighttime areas are usually 30 dBA (BLM, 2014). Most cities and towns in Wyoming have at least one school, church, or park, in addition to likely having other noise-sensitive receptors. There are most likely thousands of sensitive receptors throughout Wyoming.

18.1.14. Climate Change

18.1.14.1. 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[148]), which equalizes for the different global warming potential of each type of GHG. Where this document references

[148] 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, 2016j)

emissions of CO_2 only, the units are in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units are in MMT CO_2e.

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

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this PEIS (see Section 18.2, 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 hailstorms, flooding, heavy snowfall, blizzards, and tornadoes).

18.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C, Environmental Laws and Regulations. Wyoming has not established goals and regulations to reduce GHG emissions to combat climate change.

18.1.14.3. Wyoming Greenhouse Gas Emissions

Estimates of Wyoming's total GHG emissions vary. The U.S. Department of Energy's (DOE) Energy Information Administration (EIA) collects and disseminates national-level emissions data on other GHGs such as 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, 2015f). 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, Wyoming emitted a total of 68.4 MMT of CO_2 from fossil fuels in 2013, the highest level in the 1980-2013 reporting period. A majority (72 percent) of CO_2 emissions came from coal used by the electric power sector (Table 18.1.14-1) (EIA, 2015c). Emissions from coal are a defining characteristic of Wyoming's CO_2 emissions profile for the entire period 1980-2013. Annual emissions between 1980 and 2013 are presented in Table 18.1.14-1. Wyoming's CO_2 emissions increased intermittently year-to-year from 40 MMT in 1980 to a peak of 66.6 MMT in 2008, from which it declined slightly until 2011 before increasing again to its peak in 2013 (EIA, 2015c). Wyoming was ranked 29th in total CO_2 emissions among the 50 states and the District of Columbia in 2013, but was ranked first in per capita emissions (EIA, 2015d).

Table 18.1.14-1: Wyoming CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	49.2	Residential	0.9
Petroleum Products	11.0	Commercial	1.1
Natural Gas	8.3	Industrial	12.6
		Transportation	7.6
		Electric Power	46.6
TOTAL	**68.4**	**TOTAL**	**68.4**

Source: (EIA, 2015e)

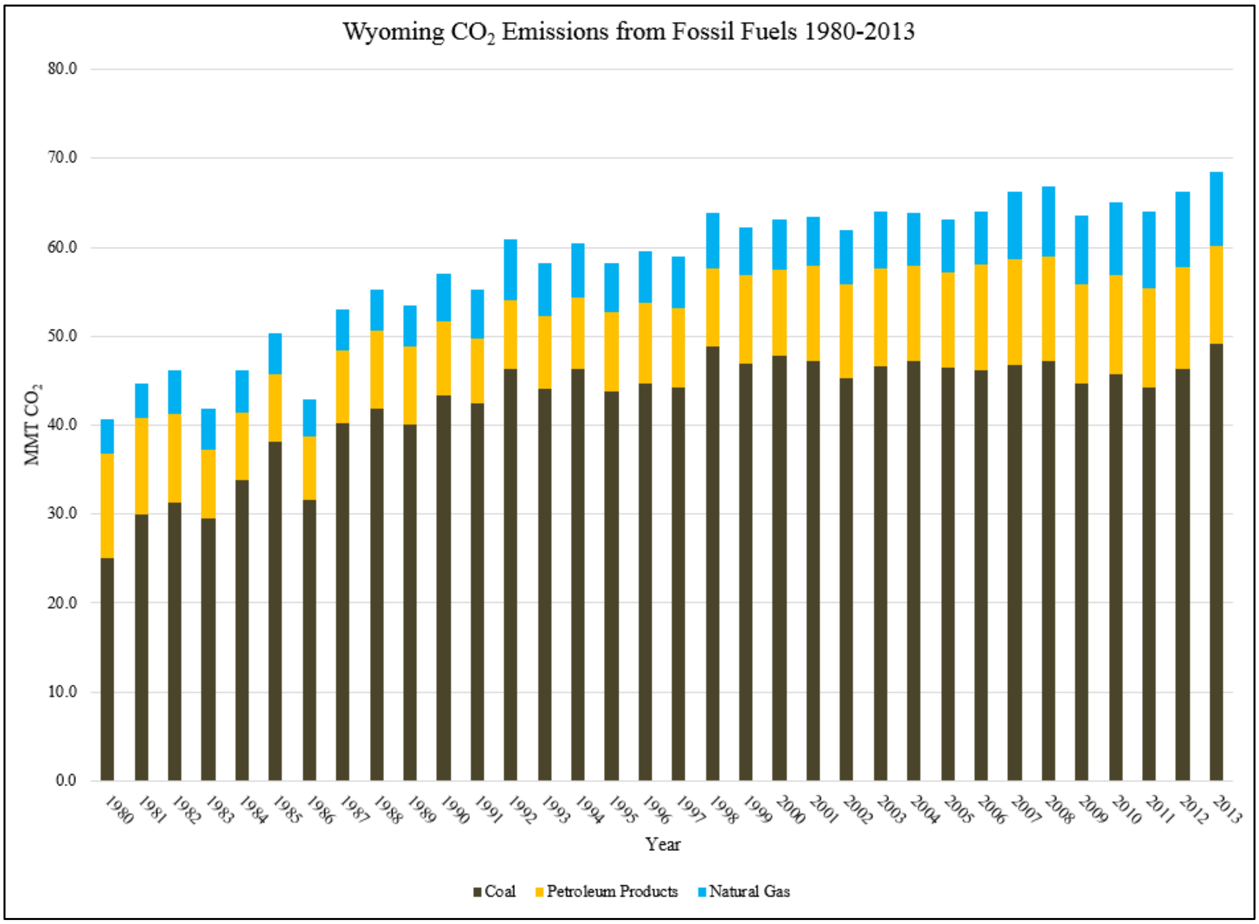


Figure 18.1.14-1: Wyoming CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015e)

The majority of Wyoming's GHG emissions is CO_2. These emissions are the result of fossil fuel combustion for the purpose of producing energy, mostly petroleum products from electric power generating facilities and coal-fired power plants. Other major GHGs emitted in Wyoming are CH_4, hydrofluorocarbons, NO_x, sulfur hexafluoride (SF_6) and perfluorocarbons (EIA, 2011).

The WDEQ commissioned The Center for Climate Change Strategies to prepare a GHG emissions inventory for Wyoming. Wyoming's total gross emissions (not counting reductions due to carbon sequestration in forests and soils) was estimated at 44.4 MMT CO2e in 1990, increasing to 55.6 MMTCO_2e in 2005, and projected to increase to 60.3 in 2010 and 69.4 in 2020 (WDEQ, 2007). For comparison, total U.S. GHG greenhouse were 6,673 million metric tons (14.7 trillion pounds) in 2013 (USEPA, 2015k). GHG emissions are dominated throughout this time period by emissions from the energy industry, either in the form of power plant emissions for fugitive emissions from oil and natural gas extraction (WDEQ, 2007).

Other than Alaska, Wyoming has the smallest population of any state, but its electricity consumption is high due to the size and types of its industries. Wyoming is a large producer of coal, natural gas, and crude oil with a majority of the electricity generation produced being exported to other states. Wyoming exports more energy and has more producing federal oil and natural gas leases than any other state in the U.S. (EIA, 2015f). Electricity generation has grown 13 percent over the past 15 years nationwide, most of which was sourced from coal (WDEQ, 2007) (EIA, 2015e).

Emissions from the transportation sector had a significant impact on Wyoming's GHG emissions in 2013. These emissions came from on road gasoline and diesel, jet fuel, marine, and rail gasoline. Gasoline and diesel from on road vehicles contribute the most to emissions. Between 1990 and 2002, emissions increased by 35 percent. Emissions are projected to grow 49 percent between 2002 and 2020 (WDEQ, 2007).

18.1.14.4. Environmental Setting: Existing Climate

The National Weather Service defines climate as the "reoccurring average weather found in any particular place" (NWS, 2011a). The widely-accepted division of the world into major climate categories is referred to as the Köppen-Geiger climate classification system. Climates within this system are classified based "upon general temperature profiles related to latitude" (NWS, 2011a). The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly characteristics (NWS, 2011a).

The majority of Wyoming falls into climate group (B) (see Figure 18.1.14-2). Climates classified as (B) are dry climates, "in large continental regions of the mid-latitudes often surrounded by mountains" (NWS, 2011b). "The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation" (NWS, 2011b). Although the majority of Wyoming falls into climate group (B), areas of southern, northwestern, western, and southwestern Wyoming fall into climate group (D). Climates classified as (D) are "moist continental mid-latitudinal climates," with "warm to cool summers and cold winters" (NWS, 2011b). In (D) climates, the "average temperature of the warmest month is greater than 50 degrees Fahrenheit (°F), while the coldest month is less than negative 22 °F" (NWS, 2011b). Winter months in (D) climate zones are cold and severe with "snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NWS, 2011b). Wyoming has four sub-climate categories, which are described in the following paragraphs. (NWS, 2011b) (NWS, 2011c)

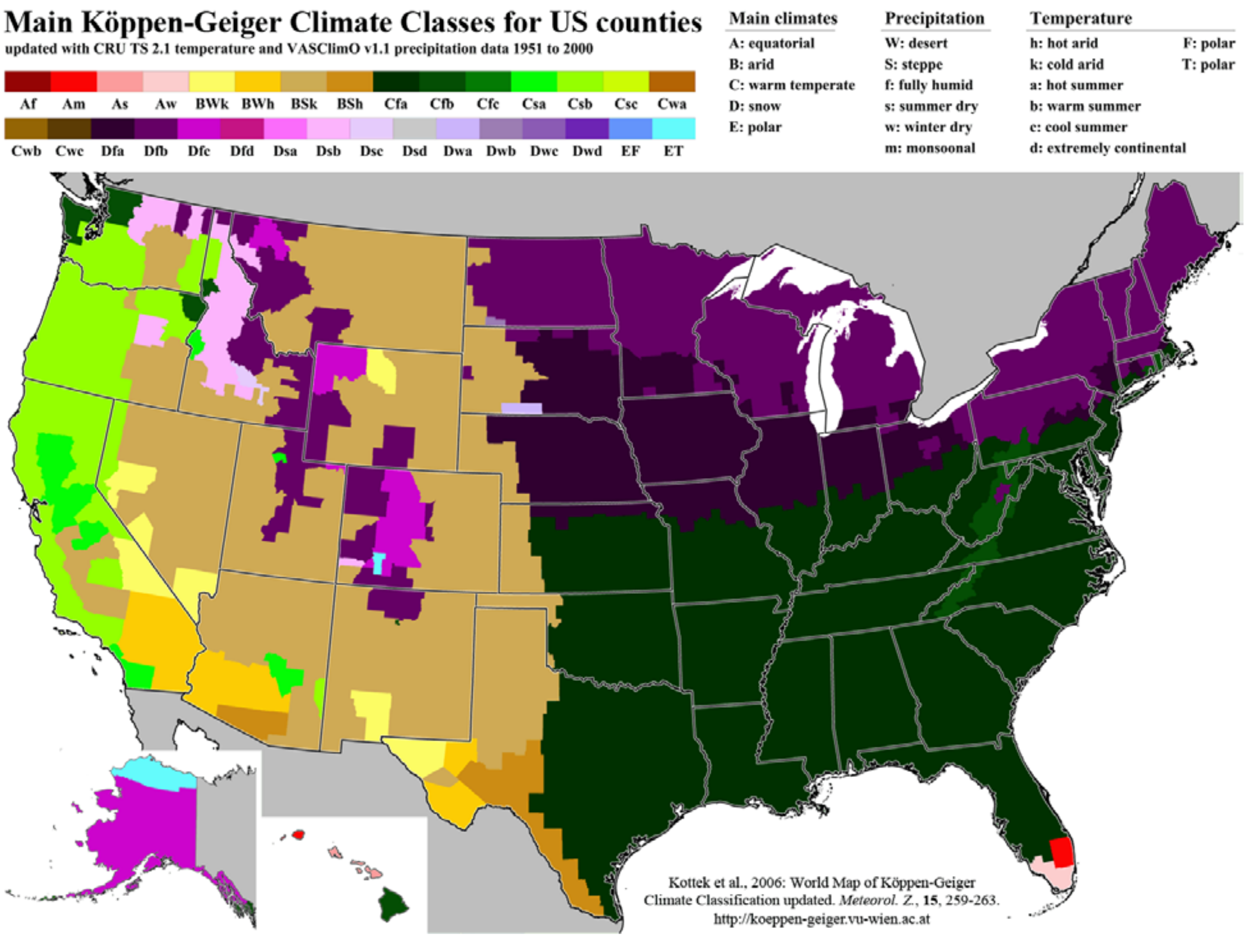


Figure 18.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, 2006)

Bsk – The Köppen-Geiger climate classification system classifies the majority of Wyoming as Bsk. Climates classified as Bsk are mid-latitude and dry. Evaporation in Bsk climates typically exceeds precipitation on average (NWS, 2011c). Average temperatures in Bsk climate zones are less than 64 °F. (NWS, 2011b) (NWS, 2011c)

BWk – The Köppen-Geiger climate classification system classifies areas of northern Wyoming as BWk. Climates classified as BWk are mid-latitude deserts, with mean annual temperatures that are less than 64 °F and are too dry to support most plant life. Evaporation in BWk climates typically “exceeds precipitation on average” (NWS, 2011c). Winters in BWk climates zones typically experience “below freezing temperature” (NWS, 2011c).

Dfb – The Köppen-Geiger climate classification system classifies portions of western and southwestern Wyoming as Dfb. Climates classified as Dfb are characterized as humid, with warm summers and snowy winters (see Figure 18.1.14-2 above). In this climate zone, the secondary classification (f) indicates substantial precipitation during all seasons. In this climate zone, the tertiary classification (b) indicates that temperatures at least four months out of the year average above 50 °F. (NWS, 2011b) (NWS, 2011c)

Dfc – The Köppen-Geiger climate classification system classifies portions of northwest and northern Wyoming as Dfc. Climates classified as Dfc are characterized as subarctic, with severe winters, no dry season, and cool summers. In this climate classification zone, the secondary classification (f) indicates substantial precipitation during all seasons. (NWS, 2011b) (NWS, 2011c)

This section discusses the current state of Wyoming’s climate with regard to air temperature, precipitation, and extreme weather events (e.g., tornadoes, severe drought, thunderstorms, and flooding) in the state’s four climate regions, Bsk, BWk, Dfb, and Dfc.

Air Temperature

Due to its elevation, the climate in Wyoming is relatively cool. Above 6,000 feet in elevation, temperatures rarely exceed 100 °F (Gray, 2015). “The warmest parts of the state are the lower portions of the Big Horn Basin, the lower elevations of the central and northeast portions, and along the east border” (Gray, 2015). The highest temperature to occur in Wyoming was on July 12, 1900 with a record of 114 °F in the city of Basin, in the Big Horn Basin (Gray, 2015). In Basin, the average maximum temperature during summer months, such as July, is 92 °F. Statewide, “mean maximum temperature in July range between 85 and 95 °F,” with mean minimum temperatures in July ranging from 50 to 60 °F (Gray, 2015). In mountainous regions of the state, average temperature maximums in July drop to approximately 70 °F, with average temperature minimums dropping to between 30 and 40 °F (Gray, 2015).

During winter months, “it is characteristic to have rapid and frequent changes between mild and cold spells” (Gray, 2015). During most winters, “there are fewer than 10 cold waves,” with the majority of cold waves moving “southward on the east side of the Divide” (Gray, 2015). Although temperature may be severe during cold waves, they are generally “not accompanied by enough snow to cause severe conditions” (Gray, 2015).

January is typically Wyoming’s coldest month, with average minimum temperatures ranging from 5 to 10 °F. In the western valley of Wyoming, average minimum temperature values drop to approximately negative 5 °F. The lowest temperature to occur in Wyoming was on February 9, 1933 with a record low of negative 66 °F in Yellowstone National Park (Gray, 2015).

The following paragraphs describe annual temperatures as they occur in the various climate classification zones:

Bsk – Cheyenne, the capital of Wyoming is located within the climate classification zone Bsk. The average annual temperature in Cheyenne is approximately 46.3 ^{o}F; 28.7 ^{o}F during winter months; 66.4 ^{o}F during summer months; 43.7 ^{o}F during spring months; and 46.6 ^{o}F during autumn months (NOAA, 2015b).

BWk – Worland, located in the lower portion of the Big Horn Basin, is within the climate classification zone BWk. The average minimum temperature in Worland is approximately 3.6 ^{o}F during the regions coldest month, January. The average annual temperature in Worland is approximately 45.6 ^{o}F; 20.0 ^{o}F during winter months; 70.1 ^{o}F during summer months; 46.5 ^{o}F during spring months; and 45.5 ^{o}F during autumn months (NOAA, 2015b).

Dfb – Kemmerer, located in southwestern Wyoming, is within the climate classification zone Dfb. The average annual temperature in Kemmerer is 37.2 ^{o}F; 15.9 ^{o}F during winter months; 58.4 ^{o}F during summer months; 36.1 ^{o}F during spring months; and 38.3 ^{o}F during autumn months (NOAA, 2015b).

Dfc – Yellowstone National Park, located in northwestern Wyoming, is within the climate classification zone Dfc. The average annual temperature in Yellowstone National Park is 36.7 ^{o}F; 17.2 ^{o}F during winter months; 56.3 ^{o}F during summer months; 35.0 ^{o}F during spring months; and 37.9 ^{o}F during autumn months (NOAA, 2015b).

Precipitation

One of Wyoming's many outstanding and unique features are its mountains and Great Plains. Generally, the mountain ranges lie in a north-south direction, and are therefore, "perpendicular to the prevailing westerlies" (Gray, 2015). As a result, "the mountain ranges provide effective barriers which force the air currents moving in from the Pacific Ocean to rise and drop much of their moisture along the western slopes" (Gray, 2015). East of the mountain ranges, Wyoming is considered semiarid (Gray, 2015).

"The Continental Divide splits the state from near the northwestern corner to the center of the southern border," which leaves the majority of the drainage areas to the east (Gray, 2015). Precipitation run-off drains into three rivers: the Colorado, the Missouri, and the Columbia. In the Great Divide Basin, otherwise referred to as the Red Desert, "there is no drainage," and therefore, "precipitation, which averages only 7 to 10 inches annually, follows creek beds to ponds or small lakes where it either evaporates or percolates into the ground" (Gray, 2015).

In Wyoming, "the period of maximum precipitation occurs in the spring and early summer" (Gray, 2015). Generally, precipitation accumulation is greatest over the mountains and in other areas with higher elevation. During summer months, rainfall is frequent, although it rarely amounts to more than a few hundredths of an inch. Occasionally, thunderstorms bring very heavy rainfall over several square miles. On a local level, there are typically several thunderstorms per year, averaging one to two inches of rainfall in a 24-hour period. "On rare occasions, 24-hour amounts range from 3 to 5 inches" (Gray, 2015). The greatest 24-hour rainfall accumulation occurred on May 31, 1927 with a total of 5.50 inches in Dull Center, near Newcastle (Gray, 2015).

Throughout Wyoming, total annual snowfall varies considerably. In eastern regions of the state and in lower elevations, snowfall can range from 60 to 70 inches. In drier, southern regions of the state, snowfall can vary from 45 to 55 inches (Gray, 2015).

The following paragraphs describe annual precipitation as it occurs in the various climate classification zones:

Bsk – Cheyenne, the capital of Wyoming is located within the climate classification zone Bsk. The average annual precipitation accumulation in Cheyenne is 15.94 inches; 1.29 inches during winter months; 6.48 inches during summer months; 5.17 inches during spring months; and 3.00 inches during autumn months (NOAA, 2015b).

BWk – Worland, located in the lower portion of the Big Horn Basin, is within the climate classification zone BWk. The average annual precipitation accumulation in Worland is 7.82 inches; 0.71 inches during winter months; 2.33 inches during summer months; 2.74 inches during spring months; and 2.04 inches during autumn months (NOAA, 2015b). Generally, snowfall is very light in the Big Horn Basin, with the annual average ranging from 15 to 20 inches "over the lower portion and 30 to 40 inches on the sides of the basin where elevations range from 5,000 to 6,000 feet" (Gray, 2015).

Dfb – Kemmerer, located in southwestern Wyoming, is within the climate classification zone Dfb. The average annual precipitation accumulation in Kemmerer is 10.35 inches; 2.10 inches during winter months; 2.65 inches during summer months; 2.84 inches during spring months; and 2.76 inches during autumn months (NOAA, 2015b).

Dfc – Yellowstone National Park, located in northwestern Wyoming, is within the climate classification zone Dfc. The average annual precipitation accumulation in Yellowstone National Park (East Station) is 14.41 inches; 2.18 inches during winter months; 4.47 inches during summer months; 4.31 inches during spring months; and 3.45 inches during autumn months (NOAA, 2015b). "At Beckler River Ranger Station in the southwest corner of Yellowstone Park, the snowfall averages 262 inches for a 20-year period" (Gray, 2015).

Severe Weather Events

In Wyoming, the most common forms of severe weather include hailstorms, flooding, heavy snowfall, blizzards, and tornadoes.

"Hailstorms are the most destructive type of local storm for this state, and every year, damage to crops and property from hail amount to many thousands of dollars" (Gray, 2015). Most hailstorms occur over open rangeland, although occasionally "a hailstorm will pass over a city and cause severe damage" (Gray, 2015). Tornadoes also occur in Wyoming, although historical records show "they are much less frequent and destructive than those that occur in the Midwest"

(Gray, 2015). This is due in large part to the fact "that most of Wyoming is open-range country and sparsely populated" (Gray, 2015). Historical records have also shown that tornadoes that occur in Wyoming are "somewhat smaller and have a shorter duration" (Gray, 2015). Tornado season in Wyoming begins in April and extends through September. The majority of tornadoes occur in the east, and during the month of June, with May following close behind (Gray, 2015).

Wyoming also experiences strong winds, particularly during winter months, where winds can reach 30 to 40 miles per hour (mph), with gusts up to 50 or 60 mph. "Prevailing direction in the different localities varies from west to southwest, through west to northwest" (Gray, 2015). "In many localities winds are so strong and constant from those directions that trees show a definite lean toward the east or southeast" (Gray, 2015).

Blizzards and heavy snowfall are also common to Wyoming. Between November and May, snow falls frequently in lower elevations, with light to moderate accumulations. "About five times a year on the average, stations at the lower elevations will have snowfall exceeding 5 inches" (Gray, 2015). "Snowfalls of 10 to 15 inches or more for a single storm occur but are infrequent outside of the mountains" (Gray, 2015). Wind frequently follows or accompanies a snowstorm, contributing to snowdrifts that can reach several feet (Gray, 2015). Between April 3 and 4, 1955 a historic snowfall 39.0 inches fell over Sheridan. During this blizzard, hazardous conditions lasted for more than 43 hours. "These conditions sometimes last a day or two, but it is uncommon for a severe blizzard to last over three days" (Gray, 2015).

During winter months, "snow accumulates to considerable depths in the high mountains" (Gray, 2015). Springtime snow melt, combined with rapid run-off from heavy thunderstorms and rainfall, "causes flash flooding on the headwater streams" (Gray, 2015)

Floods "are one of the more significant natural hazards" in Wyoming, with every country in the state having experienced some form of flooding after heavy thunderstorms, winter snow thaws, or spring rains (WOHS, 2015). Heavy thunderstorms and snowmelt are two of the most common causes of flash flooding. When "rapid run-off from heavy rain during thunderstorms" combines "with the melting of the snow pack, the flooding is intensified" (Gray, 2015). As mentioned above, Wyoming is sparsely populated. Therefore, flooding does not typically cause widespread damage. However, "when overflow occurs in the vicinity of urban communities situated near the streams, considerable damage" can result (Gray, 2015).

The most damaging flood to occur in Wyoming was on August 1, 1985 in Cheyenne. That flood caused $65 million in property loss, which in 2004 dollars, amounts to approximately $112.9 million, with 12 fatalities, and 70 injuries occurring across the state (NWS, 2015a) (WOHS, 2015). Wyoming's most deadly flood occurred in September 1923, after five days of continuous and widespread rainfall. This 100-year flooding event washed out a railroad and caused 18 fatalities (WOHS, 2015). During another significant flooding event on May 15, 1978, heavy snow and record rainfall caused "extensive damage to property, crops, and livestock in 12 counties" (WOHS, 2015). In 2004 dollars, the damage amounted to approximately $44.4 million (WOHS, 2015).

18.1.15. Human Health and Safety

18.1.15.1. Definition of the Resource

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the deployment, operation, and maintenance of towers, antennas, cables, utilities, and other equipment and infrastructure at existing and potential FirstNet telecommunication sites. There are two human populations of interest within the existing environment of health and safety, (1) telecommunication occupational workers and (2) the general public near telecommunication sites. Each of these populations could experience different degrees of exposure to hazards as a result of their relative access to FirstNet telecommunication sites and their function throughout the deployment of the FirstNet telecommunication network infrastructure.

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation, vehicular traffic, or the transportation of hazardous materials and wastes. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 18.1.1, Infrastructure.

18.1.15.2. 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 Wyoming, this resource area is regulated by the Wyoming Department of Workforce Services, Wyoming Occupational Safety and Health Administration (WYOSHA), and the WDEQ. Wyoming's Public Employees Occupational Safety and Health State Plan is an OSHA-approved "State Plan," which has adopted all OSHA state and local government employment regulations except for 1910 Subparts A, B, and C, and 1926 Subparts A and B, which were reworded to reflect the Wyoming Safety Act (OSHA, 2015a). Occupational safety regulations are enforced at the state level by WYOSHA and at the federal level by OSHA. Public health in Wyoming is regulated by the Wyoming Department of Health (WYDOH).

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C, Environmental Laws and Regulations. Table 18.1.15-1 below summarizes the major Wyoming laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 18.1.15-1: Relevant Wyoming Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Wyoming Statute: Title 35, Chapter 11, Article 12	WDEQ	States that lands and waters which were negatively affected by coal or mineral mining prior to August 3, 1977, and left unclaimed are eligible for reclamation.
Wyoming Statute: Title 35, Chapter 11, Article 16	WDEQ	Establishes requirements for voluntary remediation and provide incentives to remediate contaminated sites.
Wyoming Statutes: Title 27, Chapter 11	Wyoming Department of Workforce Services (WYDWS)	Establishes the Wyoming Occupational Health and Safety Act, and allows for the development of health and safety rules and regulations through adoption of applicable national standards.

18.1.15.3. 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 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. 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 general public who may be observing the work or transiting the area (International Finance Corporation, 2007).

Trenches and confined spaces – Installation of underground utilities, building foundations, and work in utility manholes[149] are examples of when trenching or confined space work may be necessary. Installation of telecommunication activities involves laying conduit and limited trenching (generally 6 to 12 inches in width) would occur. Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics.

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

[149] 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.

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.

Energized equipment and existing utilities – Electrical shock from energized equipment and utilities is an elevated risk at telecommunication sites due to the amount of electrical energy required for powering communication equipment and broadcasting towers. Telecommunication cables are often co-located with underground and overhead utilities, which can further increase occupational risk during earth-breaking and aerial work.

Optical fiber safety – Optical fiber cable installation and repair presents additional risks to telecommunications workers, including potential eye or tissue damage, through ingestion, inhalation, or other contact with glass fiber shards. The shards are generated during termination and splicing activities, and can penetrate exposed skin (International Finance Corporation, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation presents risk of fire or explosion (Fiber Optic Association, 2010).

Noise – Sources of excess noise at telecommunication sites include heavy equipment operation, electrical power generators and other small engine equipment, air compressors, electrical and pneumatic power tools, and road vehicles, such a diesel engine work trucks. The cumulative noise environment has the potential to exceed the OSHA acceptable level of 85 decibels (dB) per 8-hour time weighted average (TWA) (see Section 18.1.13, 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.

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 on outdoor structures or asbestos tiles and insulation in equipment sheds. The general public, unless a telecommunication work site allows unrestricted access, are typically shielded from hazardous materials and hazardous wastes that are components of telecommunication site work.

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.

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

Telecommunication Worker Occupational Health and Safety

The BLS uses established industry and occupational codes to classify telecommunications workers. For industry classifications, BLS uses the North American Industry Classification System (NAICS) codes, which identify the telecommunications industry (NAICS code 517XX) as being within the information industry (NAICS code 51). For occupational classifications, BLS uses the Standard Occupational Classification (SOC) system to identify workers as belonging to one of 840 occupations. Telecommunications occupations are identified as both 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). Figure 18.1.15-1 annotates the number of telecommunication workers in Wyoming.

As of May 2015, there were 490 telecommunication equipment installers and repairers, and 190 telecommunication line installers and repairers working in Wyoming (Figure 18.1.15-1) (BLS, 2015c). In 2013, the most recent year data are available, Wyoming did not report any cases of nonfatal occupational injuries or illnesses in the telecommunications industry (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).

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; and 7 due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2013c). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of occupational fatalities (4,585 total). Wyoming has not had any fatalities in the telecommunications industry or telecommunications occupations since 2003, when data are first available (BLS, 2015d). In the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 4 fatalities in Wyoming in 2005, and 5 in 2008 (BLS, 2015e).

Public Health and Safety

The general public is unlikely to encounter occupational hazards at telecommunication sites due to limited access. Wyoming has not recorded incidents of injuries from the public to these sites (Wyoming Department of Health, 2014). Environmental and public health data are reported at the federal level through the Center for Disease Control and Prevention (CDC) Wide-ranging

Online Data for Epidemiologic Research (WONDER). While the WONDER database cannot be searched for cases specific to telecommunication sites, many available injury categories are consistent with risks present at telecommunication sites. For example, between 1999 and 2013, there were 18 fatalities due to a fall from, out of, or through a building or structure in Wyoming (CDC, 2015a). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to the anticipated health and safety hazards.

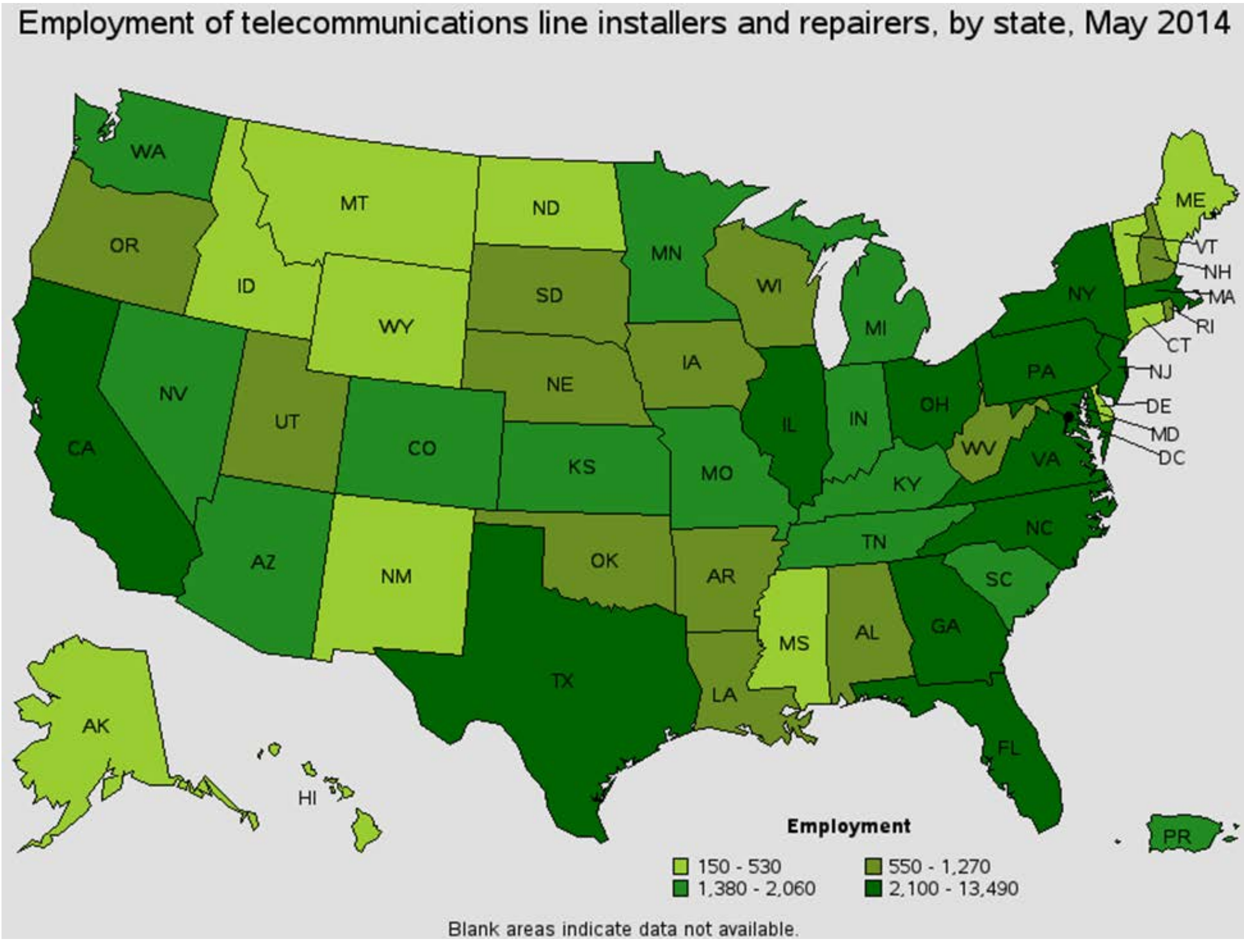


Figure 18.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015f)

18.1.15.4. 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.

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[150] or listed on the National Priorities List (NPL), as well as the Resource Conservation and Recovery Act (RCRA) Corrective Action sites and Brownfields. These regulated cleanup sites are known to contain environmental contaminants at concentrations exceeding acceptable human health exposure thresholds. Contact with high concentrations of contaminated media can result in adverse health effects, such as dermatitis, pulmonary and cardiovascular events, organ disease, central nervous system disruption, birth defects, and cancer. It generally requires extended periods of exposure over a lifetime for the most severe health effects to occur.

Wyoming does not have a State Superfund Program, so all superfund management in Wyoming is handled by the USEPA. As of October 2015, Wyoming had 9 RCRA Corrective Action sites[151], 28 brownfield sites, and 2 final Superfund/NPL sites (Mystery Bridge Road/U.S. Highway 20 and F.E. Warren Air Force Base) (USEPA, 2015l). Based on an October 2015 search of USEPA Cleanups in My Community (CIMC) database, there are no Superfund sites in Wyoming where contamination has been detected at an unsafe level, or a reasonable human exposure risk still exists (USEPA, 2015m).

Brownfield sites in Wyoming may enroll in the state Voluntary Remediation Program, which assists property owners or prospective buyers to voluntarily clean up contaminated land to bring it back to productive use (WDEQ, 2015n). One Wyoming brownfield site is the City of Cheyenne Brownfield Area-Wide Planning Program. An USEPA Area-Wide Planning Grant of $200,000 is helping redevelop the area, introducing a steam plant and four other sites along the Burlington Northern Santa Fe rail corridor, which runs through Cheyenne's West Edge community. The grant will transition the site from a public health and safety hazard, to a recreational green space, reducing storm water runoff, and aiding in pedestrian connectivity (USEPA, 2015n).

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 USEPAs of October 2015, Wyoming had 59 TRI reporting facilities. 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). 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

[150] The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) enacted in 1980, commonly referred to as the Superfund Program, governs abandoned hazardous waste sites, and collects a tax on chemical and petroleum industries. CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) in 1986; see Appendix C (USEPA, 2011).

[151] Data gathered using USEPA's Cleanups in My Community (CIMC) search on October 13, 2015, for all sites in Wyoming, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active). (USEPA, 2015l)

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). 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). The TRI 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). 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, Wyoming released 20.1 million pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from chemicals and electric utilities industries. This accounted for 0.49 percent of nationwide TRI releases, ranking Wyoming 47 of 56 U.S. states and territories based on total releases per square mile (USEPA, 2015o).

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment. As of November 12, 2012, Wyoming had no major NPDES permitted facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2012e).

The National Institute of Health, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to “visually explore data from the USEPA’s TRI and Superfund Program” (National Institute of Health, 2015a). Figure 18.1.15-2 provides an overview of potentially hazardous sites in Wyoming.

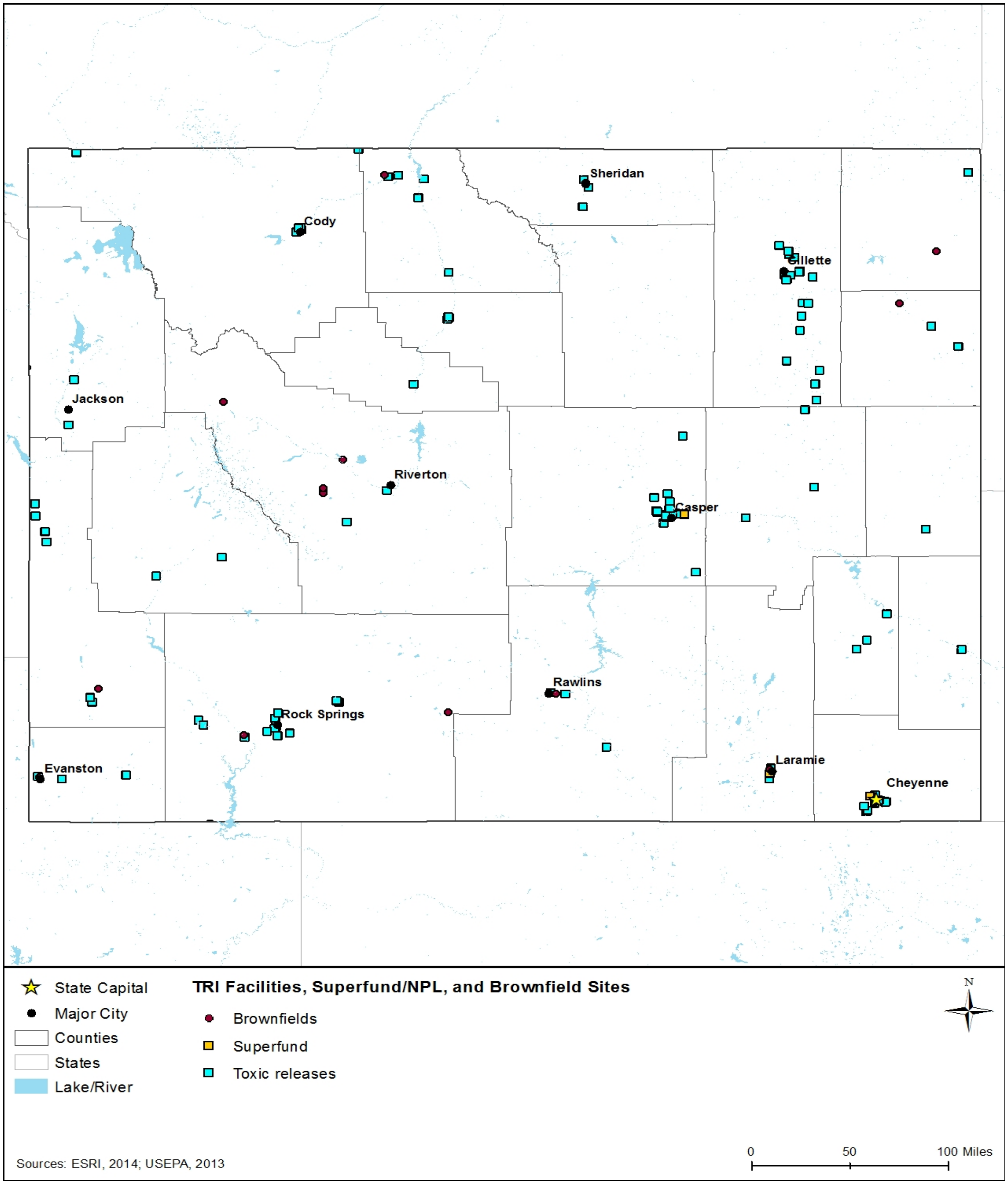


Figure 18.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Wyoming (2013)

Source: (National Institute of Health, 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.

According to BLS data, Wyoming had 11 fatalities since 2003, when data are first available, from exposure to "harmful substances or environments," although these were not specific to telecommunications (BLS, 2015e). By comparison, the BLS reported three fatalities in 2011 and three fatalities[152] in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (BLS, 2015g). 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 general public could be potentially exposed to contaminants and other hazards in a variety of ways. One example would be if occupational workers disturb contaminated soil while digging, causing hazardous chemicals to mix with an underlying groundwater drinking water sources. If a contaminant enters a drinking water source, the surrounding community could inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors.

[152] BLS Census of Fatal Occupational Injuries data for 2014 is for preliminary reporting only. Final data is expected to be released in spring 2016 (BLS, 2015h).

Spotlight on Wyoming Superfund Sites: F.E. Warren Air Force Base

Fort F.E. Warren Air Force Base occupies 6,000 acres in Laramie County, west of Cheyenne, WY. The base has been used for military operations since 1867, most recently serving as an operations center for intercontinental ballistic missile systems. Due to improper waste and resource management, numerous contaminated areas exist onsite including landfills, fire-protection training areas, spill sites, firing ranges, open burning and detonation areas, and groundwater throughout the site. (USEPA, 2015r)

Excavation of soils contaminated with polyaromatic hydrocarbons and arsenic began in 1997, during which time windblown dust impacted residents in the nearby Western Hills neighborhood. Volatile organic compounds and heavy metals were also found in groundwater used as a primary drinking water supply for nearby Nob Hill and Fair Acres residents. However, the Agency for Toxic Substances & Disease Registry (ASTDR) determined that contaminants from the dust and in the groundwater did not likely pose a public health hazard, although residents near the base continue to be concerned (Agency for Toxic Substances & Disease Registry, 2010). In 1996, the Air Force installed a municipal drinking water line to Nob Hill residents, and installed a permeable reactive barrier wall to treat contaminated groundwater in 1999 (USEPA, 2015s).

The WYDOH, Public Health Division is responsible for public health in Wyoming. The Public Health Division assists local emergency preparedness effort, provides epidemiology services, and emergency medical services (Wyoming Department of Health, 2015) At the federal level, the CDC, National Environmental Public Health Tracking Network, provides health, exposure, and hazard information, including known chemical contaminants, chronic diseases, and conditions based on geography. In 2007, the most recent year data are available, Wyoming had no reported injuries or fatalities due to reported acute toxic substance release incidents (CDC, 2015b).

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

Another health and safety hazard in Wyoming includes surface and subterranean mines. In 2014, the Wyoming mining industry ranked 13th for non-fuel minerals (soda ash, bentonite clay, helium, sand and gravel, and Portland cement), generating a value of $2.37B (USGS, 2016b). That same year, coal production in Wyoming consisted of 17 coal mining operations (1 underground and 16 surface) (EIA, 2013). Health and safety hazards know at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (BLM, 2015d). Among the general public, trespassers entering telecommunications sites would be at the greatest risk for exposure to health and safety hazards.

In Wyoming, the WDEQ, Abandoned Mine Land Division administers the Abandoned Mine Reclamation Program, and is responsible for managing AML health and safety hazards resulting from historical mining operations (WDEQ, 2015o).

Figure 18.1.15-3 shows the distribution of High Priority (Priority 1, 2 and adjacent Priority 3) AMLs in Wyoming, 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 December 2015, Wyoming had 1,247 Priority 1 and 2 AMLs, with 413 unfunded problem areas (U.S. Department of the Interior, 2015b).

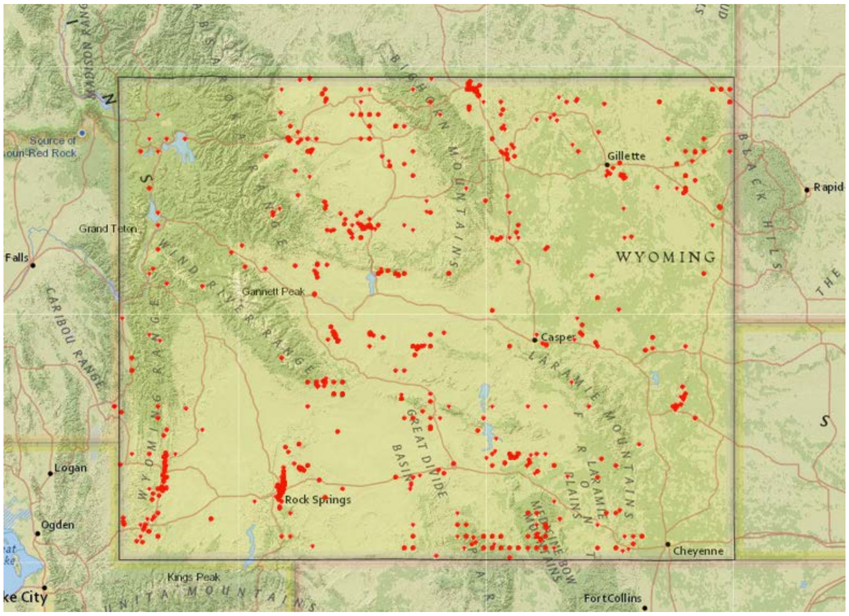


Figure 18.1.15-3: High Priority Abandoned Mine Lands in Wyoming (2013)

Source: (U.S. Department of the Interior, 2015c)

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near AMLs or coalmine fires, presenting occupational exposure risks from fire, toxic gases, and subsidence during FirstNet deployment, operation, and maintenance activities. Because the locations of many abandoned mines are unknown or hidden, these mines pose a risk to telecommunications workers because they may be encountered during deployment and maintenance operations.

Public Health and Safety

Subterranean coalmines present additional health and safety risks to the general public, by generating toxic combustible gases, which can penetrate the surface through ground fractures, potentially seeping into residential structures. Additionally, coalmine fires can consume enough sub-surface material, that risk of subsidence increases. As a result, AMLs and coalmine fires in particular, can result in evacuations of entire communities (U.S. Department of the Interior, 2015d).

18.1.15.6. Environmental Setting: Natural & Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the public. 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).

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

Telecommunication Worker Occupational Health and Safety

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

Currently, the WYOSHA 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 74 NRC-reported incidents for Wyoming in 2015 with known causes, three were attributed to natural disaster (flooding and other natural phenomenon), while 71 were attributed to manmade disasters (derailment, dumping, equipment failure, operator error, over pressuring, transport accident, or trespasser) or other indeterminate causes (U.S. Coast Guard, 2015). For example, although not related to telecommunications, during an August 2015 excavation near New Castle, WY, a contractor struck a pipeline, spilling 36 barrels of crude oil and forcing a shutdown of the system. WDEQ was notified and cleanup crews were able to recover most of the product. (U.S. Coast Guard, 2015) Such incidents present unique, hazardous challenges to telecommunication workers responding during natural and manmade disasters.

Public Health and Safety

Hazards present during natural and manmade disasters are often far-reaching, affecting large geographic areas and affecting all populations living within the area. Similar to telecommunication workers, the general public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities, potential for exposure to unknown chemical and biologic hazards, and inadequate medical support. In 2014, Wyoming reported one weather-related fatality (unknown cause) and 11 injuries. By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year. (NWS, 2015b).

Spotlight on Wyoming Natural Disaster Sites: 2010 Wind River Basin Flooding

In 2010, Wyoming experienced an unusually cold spring, leading to a late snowpack melt in May, causing rapid rises in river elevations and flooding in early June. The Little Wind River rose above flood stage, forcing the evacuation of parts of the town of Hudson, WY (Figure 18.1.15-1). The severe flooding caused numerous utility outages and road closures, hindering support services such as first responder deployment. (NWS, 2010)

On July 14, 2010, President Obama declared a major disaster for Fremont County and portions of the Wind River Indian Reservation. Preliminary damage assessments totaled $7M, primarily to roads and bridges. Public assistance from the declaration exceeded $3M. (FEMA, 2015b)

Figure 18.1.15-4: Iowa Avenue in Hudson, WY Under Water

Source: (NWS, 2010)

18.2. Environmental Consequences

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

NEPA requires agencies to assess the potential direct and indirect impacts each alternative could have on the existing environment (as characterized earlier in this section). Direct impacts are those impacts that are caused by the Proposed Action and occur at the same time and place, such as soil disturbance as a result of construction activity. 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.

18.2.1. Infrastructure

18.2.1.1. Introduction

This section describes potential impacts to infrastructure in Wyoming associated with construction, deployment, and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 18.2.1-1. As described in Section 18.2, 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 18.2.1-1: Impact Significance Rating Criteria for Infrastructure

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

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

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

NA = Not Applicable

18.2.1.3. 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 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 may be necessary with the relevant transportation authority (i.e., Wyoming Department of Roads, airport authorities, and railway companies) to ensure proper coordination during deployment.

Based on the impact significance criteria presented in Table 18.2.1-1, such impacts would be less than significant due to the temporary nature of the deployment activities, even if such impacts would be realized at one or more isolated locations. Such impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

Capacity of Local Health, Public Safety, and Emergency Response Services

The capacity of local health, public safety, and emergency response services would experience less than significant impacts during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of 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 18.2.1-1, 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 18.2.1-1, any potential impacts would be less than significant during deployment. As described above, during deployment and system optimization, existing services would remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state, and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to complement such practices and SOPs in a positive manner; therefore, only beneficial or complementary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience beneficial impacts through enhanced communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus the infrastructure would also experience a positive and beneficial impact. Disposal or reuse of old public safety communications infrastructure would also likely need to be considered once the specifics are known. Any negative impacts would be expected to be less than significant given the short-term nature of the deployment activities.

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

Wyoming's Public Safety LMR network environment is facing transition and reflects the challenges of the need for greater system capabilities, investment in VHF upgrades and site coverage expansion, and sustainment of analog to digital P25 conversion, as well as planning for adoption of broadband and technology modernization. There are close to 400 commercial towers in Wyoming (FCC, 2015). Commercial telecommunication systems, communications, or level of service would experience no impacts, as such commercial assets would be using a different spectrum for communications. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, such spectrum use may be over-built or under-utilized.[153] 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 Wyoming PSC regulates private investor-owned public utilities such as electric and water companies. 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 exact specific 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 exact 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.

[153] 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.

18.2.1.4. 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.

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 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 development 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.
- Wireless Technologies
  - Deployable Technologies: 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.
- 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 Nationwide Public Safety Broadband Network (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 development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to infrastructure include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POP), huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase, however, it is anticipated that this tie-in would cause less than significant impacts as the activity would be temporary and minor.
  - New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new or 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.
  - 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, potential addition of power units, structural hardening, and physical security measures could potentially have beneficial impacts on existing infrastructure assets, depending on the site-specific plans.
  - Deployable Technologies: Deployable technologies such as Cell on Wheels (COW), Cell on Light Trucks (COLT), and Site on Wheels (SOW) are comprised of cellular base stations, sometimes with expandable antenna masts, and generators that may require connection to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road rights-of-way (ROW) and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation congestion and delays. Implementation of deployable technologies could result in potential impacts to infrastructure resources in terms of infrastructure expansion, if deployment requires paving of previously unpaved surfaces or other new infrastructure build to accommodate the deployable technology. Also, beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Where deployable technologies would be implemented on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, or where aerial deployable technologies may be launched or recovered on existing paved surfaces, it is anticipated that there would be no impacts to infrastructure resources because there would be no disturbance of the natural or built environment.

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. These impacts are expected to be less than significant as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the on-going phase of deployment, and minor. Chapter 19, 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.

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 19, 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.

18.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[154]

Deployable Technologies Alternative

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

Deployment Impacts

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

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access roads or utility ROWs, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts would likely still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and

[154] As mentioned above and in Section 18.1.2 Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

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 from deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 18.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

18.2.2. Soils

18.2.2.1. Introduction

This section describes potential impacts to soil resources in Wyoming associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 18.2.2-1. As described in Section 18.1.2, 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 18.2.2-1: 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

18.2.2.3. Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern of nearly every construction activity that involves ground disturbance. Construction erosion typically only occurs in a small area of land with the actual removal of vegetative cover from construction equipment or by wind and water erosion. Of concern in Wyoming and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment could impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Soils with medium to high erosion potential in Wyoming include those in the Aquents, Aquepts, Argids, Calcids, Cambids, Cryalfs, Cryepts, Cryolls, Orthents, Udalfs, Ustalfs, Ustepts, Usterts and Ustolls suborders, which are found throughout the state (see Section 18.1.2.6, Soil Erosion and Figure 18.1.2-2).

Based on the impact significance criteria presented in Table 18.2.2-1, building of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. Furthermore, deployment sites that are large-scale or adjacent to other construction sites (i.e., cumulatively large-scale sites) could result in long-term erosion that might not be reversed for several years.

To the extent practicable, FirstNet would minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 19).

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 18.2.2-1, and due to the relatively small scale (less than 1 acre) of most FirstNet project sites, minimal topsoil mixing is anticipated. Potential impacts could be further minimized by implementing BMPs and Mitigation Measures (see Chapter 19).

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Heavy equipment could cause perceptible compaction and rutting of susceptible soils, particularly if BMPs and mitigation measures are not implemented.

Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 18.1.2.4, Soil Suborders). The most compaction susceptible soils in Wyoming are those in the Aquepts, Aquolls, and Hemists suborders, which are found generally in north-central and western Wyoming (Figure 18.1.2-2). These soils constitute approximately 3.27% percent of Wyoming land area, and are found across the state. 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 18.2.2-1, 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.

18.2.2.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand holes, pulling vaults, junction boxes, huts, and POP, structures, and would not impact soil resources because it would not produce perceptible changes to soil resources.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no impacts to soil resources. If physical access is required to light dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite

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

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact soil resources, it is anticipated that this activity would have no impact on soil resources.

Activities with the Potential to Have Impacts

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

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing paved, 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 or near bodies of water could potentially impact soil resources at and near the landings or facilities on shore to accept submarine cable. Soil erosion and topsoil mixing could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Perceptible soil compaction and rutting could potentially occur due to heavy equipment use during these activities depending on the duration of 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 are needed, structural hardening, and physical security measures are needed they may require ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads, and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way for deployment activities. Chapter 19, 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. 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 19, 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.

18.2.2.5. 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 19, 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. 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 19, 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 18.1.2, Soils.

18.2.3. Geology

18.2.3.1. Introduction

This section describes potential impacts to Wyoming geology resources associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 18.2.3-1. As described in Section 18.2, 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 18.2.3-1: Impact Significance Rating Criteria for Geology

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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
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.
	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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
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 Resources impacts	Magnitude or Intensity	Severe, widespread, observable impacts to paleontological resources.	Effect that is potentially significant, but with mitigation is less than significant.	Limited impacts to paleontological and/or fossil resources.	No perceptible change in paleontological resources.
	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory.		Areas with known paleontological resources occur within the state/territory, but may be avoidable.	Areas with known paleontological resources do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
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

18.2.3.3. Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, landslides, and volcanic activity, and those that would be impacts from the project, such as land subsidence, mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

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 18.1.3.8, areas of greatest seismicity in Wyoming are concentrated in the northwest portions of the state (Figure 18.1.3-5); locations within Yellowstone National Park are at the greatest risk of experiencing a significant earthquake event. Based on the impact significance criteria presented in Table 18.2.3-1, 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 or active fault zones. Given the potential for minor earthquakes in parts of Wyoming, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 19) could help avoid or minimize the potential impacts.

Volcanic Activity

Volcanic activity is common throughout the Yellowstone area in the northwestern corner of Wyoming (Figure 18.1.3-4). Equipment that is exposed to volcanic activity is subject to misalignment, alteration, or destruction; all of these activities could result in connectivity loss. Based on the impact significance criteria presented in Table 18.2.3-1, volcanic activity could be potentially significant if FirstNet's deployment locations were within high-risk volcanic hazard areas. Given the potential for volcanic activity in Wyoming, some amount of infrastructure could be subject to volcanic events, in which case BMPs and mitigation measures (see Chapter 19) would help avoid or minimize the potential impacts.

Landslides

As discussed in Section 18.1.3.8, portions of Wyoming are highly susceptible to, or demonstrate high incidence of, landslides. Anthropogenic[155] disturbances to the landscape, snow melt, or heavy precipitation events increase the likelihood of landslide events in Wyoming. Based on the impact significance criteria presented in Table 18.2.3-1, potential impacts to landslides from deployment operations or operation of the Proposed Action would have less than significant

[155] 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, 2016k).

impacts as it is likely that the project would attempt to avoid areas that are prone to landslides; however, landslide impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. Where infrastructure is subject to landslide hazards, BMPs and mitigation measures, as discussed in Chapter 19, could help avoid or minimize the potential impacts.

Land Subsidence

As discussed in Section 18.1.3.8, land subsidence is not considered a major risk in Wyoming. Land subsidence is generally attributed to subsidence over formerly mined areas. To the extent practicable, FirstNet would avoid deployment in known or abandoned mined areas. However, given that karst topography exists in many counties throughout the state, some amount of infrastructure may subject to landslide hazards, in which case BMPs and mitigation measures, as discussed in Chapter 19, could help avoid or minimize the potential impacts.

Potential Mineral and Fossil Fuel Resource Impacts

Equipment deployment near mineral and fossil fuel resources are not likely to affect these resources. Rather the new construction is only likely to limit access to extraction of these resources. Based on the impact significance criteria presented in Table 18.2.3-1, impacts to mineral and fossil fuel resources are unlikely as the Proposed Action could only be potentially significant if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. To the extent practicable, FirstNet would avoid deployment in areas where these resources exist.

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 18.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 18.1.3.6., marine fossils are found throughout the state in with an abundance found in the Green River Formation. It is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized. Potential impacts to fossil resources should be considered on a site-by-site basis, and BMPs and mitigation measures (see Chapter 19) could further help avoid or minimize the potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that degrade or alter surface geology, bedrock, or topography could cause measurable changes in physiographic characteristics of an area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 18.2.3-1, impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and less than significant as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures (see Chapter 19) could be implemented to help avoid or minimize the 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 disturbing activity.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact geologic resources, it is anticipated that this activity would have no impact on geologic resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral and fuel resources and paleontological resources. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water is not expected to impact geologic 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 specific geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.
- Wireless Projects

  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or disturbance of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if the additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. However, where equipment is permanently installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact on the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could include minimal removal of bedrock, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet projects are likely to be small scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small scale. These impacts are expected to be less than significant, due to the minor amount of paving or new infrastructure needed to accommodate the deployables See Chapter 19, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

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

The operation of the Preferred Alternative could be affected by 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 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

18.2.3.4. 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, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be less than significant due to the minor amount of paving or new infrastructure needed to accommodate the deployables. Chapter 19, 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.

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 19, 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) from of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 18.2.3, Geology.

18.2.4. Water Resources

18.2.4.1. Introduction

This section describes potential impacts to water resources in Wyoming associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 18.2.4-1. As described in Section 18.2, 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 18.2.4-1: 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, Safe Drinking Water Act (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

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Floodplain 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.
	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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
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
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).
NA = Not Applicable

18.2.4.3. Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the CWA requires states to assess and report on the quality of waters in their state. Section 303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

Of the waters assessed in Wyoming, including 16 percent of rivers and streams and 6 percent of lakes, reservoirs, and ponds, most are in good condition. Designated uses include agriculture water supply, and aquatic life. Groundwater quality within the state is generally good for most domestic uses.

Deployment activities could contribute to water quality impacts in a number of ways. Vegetation removal on site exposes soils to rain and wind that could increase erosion. Impacts to water quality may occur from post construction vegetation management, such as herbicides, that may leach into groundwater or move to surface waters through soil erosion or runoff, spray drift, or inadvertent direct overspray. Fuel, oil, and other lubricants from equipment could contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, pH 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 storm water pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs could reduce potential impacts to surface water quality.

The deployment activities would be unlikely to violate applicable state, federal, or 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 18.2.4-1, water quality impacts would likely be less than significant, and could be further reduced if BMPs and mitigation measures (see Chapter 19) 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 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 Wyoming dewatering requirements. Any groundwater extracted during dewatering activities or as required by a dewatering permit may need to be treated prior to discharge or disposed of at a wastewater treatment facility.

It is unlikely that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer, and based on the impact significance criteria presented in Table 18.2.4-1, there would likely be less than significant impacts on groundwater quality within most of the state. There is little potential for groundwater contamination within a watershed or multiple watersheds. In areas where groundwater is close to the surface, then site-specific analysis, BMPs, and mitigation measures could be implemented to further reduce potential impacts.

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on humans, buildings, roads and other infrastructure. The 500-year floodplain is the area of minimal flood hazard, where there is a 0.2-percent-annual-chance flood. Some projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 18.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet's likely deployment activities, on the watershed or subwatershed level, would occur inside the 500-year floodplain, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede or redirect flood flows or impact floodplain hydrology, and would not occur during flood events with the exception of deployable technologies which may be deployed in response to an emergency. Additionally, any effects would be temporary, lasting no more than one season or water year,[156] or occur only during an emergency.

Examples of activities that would have less than significant impacts include:

[156] 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, 2016c)

- Construction of any structure in the 500-year floodplain that is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.
- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures could reduce any risk of additional impacts to floodplain degradation (see Chapter 19).

Drainage Pattern Alteration

Flooding and erosion from land disturbance could changes drainage patterns. Storm water runoff causes erosion while construction activities and land clearing could change drainage patterns. Clearing or grading activities, or the creation of walls or berms, could alter water flow in an area or cause changes to drainage patterns. Drainage could be directed to storm water drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage could cause increased erosion, changes in storm water 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); storm water increases; or altered flow patterns.

According to the significance criteria in Table 18.2.4-1 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 storm water runoff.
- Activities designed so that stormwater is contained on site and does not flow to or impact surface waterbodies offsite on other properties.
- Activities designed so that the amount of storm water generated before construction is the same as afterwards.
- Activities designed using low impact development (LID) techniques for storm water.

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; 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.

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 18.2.4-1. Projects that include minor consumptive use of surface water with less than significant impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) are likely to have less than significant impacts on flow alteration, on a watershed or subwatershed level. Examples of projects likely to have less than significant impacts include:

- Construction of any structure in a 100-year or 500-year floodplain that is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns offsite or into surface water bodies that have not received that volume of storm water previously.
- Minor clearing or grading activities.

Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be less than significant impacts to flow alteration. BMPs, mitigation measures could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 18.1.4.7, approximately 80 percent of Wyoming residents use groundwater for their drinking water. Water supply demand from the deployment activities is unlikely to exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would unlikely cause any impacts to water quality. Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater, generation.
- Storage of petroleum or chemical products.
- Use of pesticides, herbicides, or insecticides during or after construction of a commercial, industrial, or recreational use.

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

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

18.2.4.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to water resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable*:* Lighting up of dark fiber would have no impacts to water resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would impact water resources from a short-term increase in suspended solid in the water. Site-specific impact assessment would be required to marine and shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity. 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 and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - 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 water resources. However, if additional power units, structural hardening, and physical security measures required ground disturbance, impacts to water resources could occur, including increased suspended solids leading to impaired water quality and impacts to groundwater from excavation.
  - Deployable Technologies: Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Where deployable technologies would be implemented on existing paved surfaces, or where aerial and vehicular deployable technologies may be used on existing paved surfaces, it is anticipated that there would be no impacts to water resources because there would be no ground disturbance.
  - Deployment of drones, balloons, blimps, or piloted aircraft could have indirect impacts on water quality if fuels spill or other chemicals seep into ground or surface waters. In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts, but are expected to be less than significant due to the small-scale of individual activities. Chapter 19, 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; 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 17, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

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 ROWs. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected. Chapter 19, 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.

18.2.4.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to water resources if those activities occurred on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving, however, these activities would be isolated and short term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of potential impact depends on the land area affected, installation technique, and location. Implementing the BMPs and mitigation measures identified in Chapter 19 could further avoid or reduce potential impacts. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. 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. Chapter 19, 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 less than significant impacts to water resources associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods of time, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies, however, due to the limited and temporary nature of the deployable activities, it is anticipated that these potential impacts would be less than significant. Site maintenance, including mowing or herbicides, may result in less than significant effects to water quality, due to the small scale of expected FirstNet activities in any particular location. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above. Chapter 19, 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 18.1.4, Water Resources.

18.2.5. Wetlands

18.2.5.1. Introduction

This section describes potential impacts to wetlands in Wyoming associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 18.2.5-1. As described in Section 18.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to wetlands addressed in this section are presented as a range of possible impacts.

Table 18.2.5-1: Impact Significance Rating Criteria for Wetlands

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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Indirect effects:[2] change in function(s)[3] change in wetland type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.).	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No changes in wetland function or type.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Long-term or permanent.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA

[1] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories. Category 1 are the highest quality, highest functioning wetlands
[2] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type
[3] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, threatened and endangered species habitat, biodiversity, recreational/social value.

NA = Not Applicable

18.2.5.3. Description of Environmental Concerns

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

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

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, light, and other human disturbance. To the extent practicable or feasible, FirstNet and/or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (see Chapter 19).

In Wyoming, palustrine (freshwater) wetlands found on river and lake floodplains across the state are the main type of wetlands, as shown in Figure 18.1.5-1 and Table 18.1.5-2. Wyoming has over 975,000 acres of palustrine wetlands, as shown in Table 18.1.5-2.

Based on the impact significance criteria presented in Table 18.2.5-1, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, the deployment activities would be unlikely to violate applicable federal, state, and local regulations.

As discussed in Wetlands, Section 18.1.5.4, wetlands of special concern include peatlands. If any of the proposed deployment activities were to occur in these high quality wetlands, potentially significant impacts could occur. High quality wetlands occur throughout the state, and are not always included on state maps; therefore, site-specific analysis may be needed. BMPs and mitigation measures could be implemented to help avoid potentially significant impacts to wetlands.

Potential Other Direct Effects

Direct impacts consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through chemical, mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as storm water discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 18.2.5-1, 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) could cause potentially significant impacts. In addition, introduction and establishment of invasive species to high quality wetlands within a watershed or multiple watersheds could be 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, site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (see Chapter 19).

Examples of activities that could have other direct effects to wetlands in Wyoming include:

- Vegetation Clearing: removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.
- Ground Disturbance: Increased amounts of stormwater runoff in wetlands could alter water level response times, depths, and duration of water detention. Reduction of watershed infiltration capacity could cause wetland water depths to rise more rapidly following storm events.
- Direct Hydrologic Changes (flooding or draining): Greater frequency and duration of flooding could destroy native plant communities, as could depriving them of their water supply. Hydrologic changes could make a wetland more vulnerable to pollution. Increased water depths or flooding frequency could distribute pollutants more widely through a wetland. Sediment retention in wetlands is directly related to flow characteristics, including degree and pattern of channelization, flow velocities, and storm surges.
- Direct Soil Changes: Changes in soil chemistry could lead to degradation of wetlands that have a specific pH range and/or other parameters.
- 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:[157] Change in Function(s)[158] or Change in Wetland Type

Indirect effects to wetlands could include change in wetland function or conversion of a resource to another type (i.e., wetland to an open body of water). The construction of curb and gutter systems diverts surface runoff and could cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to both 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, site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (see Chapter 19).

Examples of functions related to wetlands in Wyoming that could potentially be impacted from construction-related deployment activities include:

- Flood Attenuation: Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they could lower flood peaks by providing detention of storm flows. Correspondingly, disturbance of the wetlands (e.g., dredging or filling) could proportionately reduce water storage function.
- Bank Stabilization: By reducing the velocity and volume of flow, wetlands provide erosion control, floodwater retention, and reduce stream sedimentation.
- Water Quality: Water quality impacts on wetland soils could eventually threaten a wetland’s existence. Where sediment inputs exceed rates of sediment export and soil consolidation, a wetland would gradually become filled.
- Nutrient Processing: Wetland forests retain ammonia during seasonal flooding. Wetlands absorb metals in the soils and by plant uptake via the roots. They also allow metabolism of oxygen-demanding materials and reduce fecal coliform populations. These pollutants are often then buried by newer plant material, isolating them in the sediments.
- Wildlife Habitat: Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding could harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes could have impacts on the preferred food supply and animal cover.
- Recreational Value: Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- Groundwater Recharge: Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

[157] 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.

[158] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, threatened and endangered species habitat, biodiversity, recreational/social value.

According to the significance criteria defined in Table 18.2.5-1, 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 approximately 1 million acres of wetlands in Wyoming are not considered high quality, deployment activities could have less than significant indirect impacts on wetlands in the state. BMPs and mitigation measures could be implemented, as feasible and practicable, to reduce potential impacts to all wetlands.

In areas of the state with high quality wetlands, there could be potentially significant impacts at the project level that would likely be analyzed on a case-by-case basis. BMPs and mitigation measures could be implemented, as feasible and practicable, to reduce potential impacts to wetlands.

18.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations could be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

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

Activities Likely to Have No Impacts

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

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

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures 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/or 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 or near bodies of water would potentially impact wetlands bound along shorelines. Additional project-specific environmental review 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 the 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 (see Chapter 19) 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 19, 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 other potential 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 19, 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.

18.2.5.5. 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/or 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 19, 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 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 ROWs would be utilized for maintenance and inspection activities. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects to wetlands, due to the limited nature of site maintenance activities, including mowing and application of herbicides. Chapter 19, 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 18.1.5, Wetlands.

18.2.6. Biological Resources

18.2.6.1. Introduction

This section describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Wyoming associated with deployment and operation of the Proposed Action and its Alternatives. Chapter 19, 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.

18.2.6.2. 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 18.2.6-1. As described in Section 18.2, 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 18.2.6.3, 18.2.6.4, and 18.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 18.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Wyoming.

Table 18.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury /mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including: Marine Mammal Protection Act (MMPA), Magnuson Stevens Fishery Conservation And Management Act (MSFCMA), MBTA, and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed within Wyoming for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect 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 Wyoming 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 Wyoming 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

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long-term loss of migratory pattern/path or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with 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 Wyoming 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 Wyoming 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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated, or short-term effects that are reversed within one breeding season.	NA
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout Wyoming.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons.	NA

NA = Not Applicable

18.2.6.3. Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in Wyoming's environment are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are permanent or temporary loss or disturbance of individual plants. Based on the impact significance criteria presented in Table 18.2.6-1, 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. Direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale. The implementation of BMPs and mitigation measures and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical disturbances that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat. Areas near urban areas, such as Cheyenne, Jackson, and Laramie, have experienced land use changes.

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. Further, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case BMPs and mitigation measures could be implemented to help minimize or avoid potential impacts.

Indirect Injury/Mortality

Indirect effects are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality could include stress related to disturbance. The alteration of soils or hydrology within a localized area could result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to the small size of expected FirstNet activities. Increasing or decreasing hydrology in an area could lead to moisture stress and/or mortality of plant species that are adapted to specific hydrologic regimes. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment, though BMPs and mitigation measures would help to minimize or avoid the potential impacts.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for terrestrial vegetation (e.g., forest migration) are expected as a result of the Proposed Action, given the small scale of deployment activities.

Reproductive Effects

No reproductive effects to terrestrial vegetation are expected as a result of the Proposed Action given the small scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species could have a dramatic effect on natural resources and biodiversity. Wyoming passed the state statute referred to as the Wyoming Weed and Pest Control Act to control designated weeds and pests (USDA, 2014). A total of 30 state-listed noxious weeds are regulated in Wyoming (USDA, 2014).

When non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. Natural or native community species evolve together into an ecosystem with many checks and balances that limit the population growth of any one species. These checks and balances include such things as: predators, herbivores, diseases, parasites, and other organisms competing for the same resources and limiting environmental factors. However, when an organism is introduced into an ecosystem in which it did not evolve naturally, those limits may not exist and its numbers could sometimes dramatically increase. The unnaturally large population numbers could then have severe impacts to the environment, local economy, and human health. Invasive species could out-compete the native species for food and habitats and sometimes even cause their extinction. Even if natives are not completely eliminated, the ecosystem often becomes much less diverse.

The potential to introduce invasive plants within construction zones and during long-term site maintenance 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 would help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to terrestrial vegetation resources and others would not. In addition, the same type of Proposed Action infrastructure 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 terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology,[159] and the nature as well as the extent of the habitats affected.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to terrestrial vegetation because there would be no ground disturbance. If required, and if done in existing huts, installation of new associated equipment would also have no impacts to terrestrial vegetation. The section below addresses potential impacts to terrestrial vegetation if construction of new huts or other equipment is required or construction for laterals/drops is conducted.
  - 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 terrestrial vegetation. The section below addresses potential impacts to terrestrial vegetation if construction of new boxes, huts, or other equipment is required.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact 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

[159] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

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 development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Implementation of BMPs and mitigation measures could help avoid or minimize potential impacts.
    - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to terrestrial vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Implementation of BMPs and mitigation measures could help avoid or minimize potential impacts.
    - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in bodies of water would not impact terrestrial vegetation. However, impacts to terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cables could potentially occur as a result of land clearing, excavation

activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Implementation of BMPs and mitigation measures could help avoid or minimize potential impacts.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct or indirect injury to plants, vegetation loss, and invasive species effects. Implementation of BMPs and mitigation measures could help avoid or minimize potential impacts.

- Wireless Projects
  - New Wireless Communication Towers or Backhaul Equipment: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads), microwave facilities, or access roads could result in impacts to terrestrial vegetation. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to terrestrial vegetation. However, if new power units, replacement towers, structural hardening, and physical security measures require land clearing or excavation activities, impacts would be similar to new wireless construction.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct impacts to terrestrial vegetation if deployment occurs on vegetated areas, or the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact terrestrial vegetation if launch and recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs.

In general the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species’ phenology, and the nature and extent of the vegetation affected. These impacts are expected to be less than significant due to the small-scale of expected deployment activities. Chapter 19, 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 no significant 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 excepted activities. Chapter 19, 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.

<u>Deployable Technologies Alternative</u>

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.

18.2.6.3.1.1.1.1. 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 19, 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.

18.2.6.3.1.1.1.2. Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to terrestrial vegetation associated with routine operations and maintenance due to the relatively small scale of likely FirstNet project sites. The impacts could vary greatly among species, vegetative community, and geographic region, but are expected to remain less than significant.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. 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 18.1.6.3, Terrestrial Vegetation.

18.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in Wyoming 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. Based on the impact significance criteria presented in Table 18.2.6-1, 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.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Wyoming. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, preferred vegetation along roadways, areas of insect relief, and ease of travel along road corridors. Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur.

Entanglement in fences or other barriers could be a source of mortality or injury to terrestrial mammals, though entanglements would likely be isolated, individual events.

If tree-roosting bats, and particularly maternity colonies are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small 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 help avoid disturbance to bats.

Birds

Wyoming is located within both the Central and Pacific Flyways. Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and could violate MBTA and BGEPA. Generally, collision events occur to “poor” fliers (e.g., ducks), night-migrating birds, heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (Gehring, Kerlinger, & and Manville, 2011).

Avian mortalities or injuries 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 injury/mortality are not anticipated to be widespread or affect bird populations due to the small scale of likely FirstNet actions.

Direct mortality and injury to birds of Wyoming are not likely to be widespread or affect populations of species as a whole; individual species impacts may be realized depending on the nature of the deployment activity. If siting considerations and BMPs and mitigation measures are implemented (Chapter 19), 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

Wyoming's reptiles and amphibians occupy a wide variety of habitat types, from the arid plains in the east to the moist coniferous forests of the west. Very few species are widespread throughout the state; instead, most species are commonly found in either the plains region in the east or the mountainous region in the west. Direct mortality to amphibians or reptiles could occur in construction zones either by excavation activities or by vehicle strikes; however, these events are expected to be temporary and isolated, affecting only individual animals.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Wyoming 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 disturbances that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat, and impeding access to resources and mates. Areas near Jackson and Casper have experienced land use changes due to urbanization. However, a large portion of the state is mountainous and consists of unfragmented forest.

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.

Potential effects of vegetation and habitat loss, alteration, or fragmentation are described for Wyoming's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Wyoming and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., elk, moose) by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals (e.g., squirrels, rabbits) 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 implementing BMPs and mitigation measures.

Birds

The direct removal of many migratory bird nests are prohibited under the MBTA. The USFWS provides regional guidance on the most critical time periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation could affect avian species directly by loss of nesting, foraging, stopover locations, and cover habitat.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced in IBAs within the state. 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 on passerine[160] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration could have major impacts to species that migrate in large flocks and concentrate at stop overs. BMPs and mitigation measures, including nest avoidance during construction-related activities, could help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for Wyoming's amphibians and reptiles typically consist of wetlands and upland forests. Impacts are expected to be less than significant. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 19) could help to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 18.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects on Wyoming's amphibian and reptile populations, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.[161]

Terrestrial Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many common terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state, therefore no significant effects to terrestrial invertebrates are expected. Impacts to sensitive invertebrate species are discussed below in Section 18.2.6.6, Threatened and Endangered Species and Species of Concern.

[160] 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.
[161] See Section 18.2.5, Wetlands, for a discussion of BMPs for wetlands.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

<u>Terrestrial Mammals</u>

Stress from repeated disturbances during critical time periods (e.g., mating) could reduce the overall fitness and productivity of young and adult terrestrial mammals. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would be unlikely to occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

<u>Birds</u>

Repeated disturbance, especially during the breeding and nesting season, could cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, 1997). The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

<u>Reptiles and Amphibians</u>

Changes in water quality and quantity, especially during the breeding seasons, could cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would be unlikely to occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

<u>Terrestrial Invertebrates</u>

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. Potential effects to migration patterns of Wyoming's amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below.

<u>Terrestrial Mammals</u>

Large game animals (e.g., elk, moose) have well-defined migratory routes. Route knowledge is passed on from one generation to the next and includes important feeding and calving areas.

Small mammals (e.g., bats) also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula.[162] Any clearance, drilling, and construction activities needed for network deployment, including noise associated with these activities, has the potential to divert mammals from these migratory routes. Impacts could vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be less than significant given the short-term nature and limited geographic scope for individual activities. Implementation of BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. For example, as a group, shorebirds migrating through Wyoming undertake some of the longest-distance migrations of all animals. Wyoming is located within both the Central and Pacific Flyways. Covering the eastern three quarters of Wyoming, the Central Flyway occurs from the Gulf Coast of Texas to the Canadian boreal forest. The Pacific Flyway covers the western quarter of Wyoming, west of the continental divide, and spans from the west coast of Mexico to the arctic. According to the Rockies Audubon Society (RAS), a total of 44 IBAs, covering approximately 9 million acres, have been identified in Wyoming, including breeding range,[163] migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as native grasslands, grasslands, sage brush, and wetland/riparian[164] areas. These IBAs are widely distributed throughout the state, although the largest concentration of IBAs are located in the central and western regions of the state, within the Great Plains and Rocky Mountains. The Red Desert covers approximately 4.5 million acres in central Wyoming and provides habitat for bald eagle, golden eagle, greater sage-grouse, and a number of other hawks, sparrow, and wetland bird species (National Audubon Society, 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 could help to further avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of mole salamanders and the wood frog are known to seasonally migrate in Wyoming. These amphibians often travel by the hundreds on their migration pathway that often crosses roadways. Mole salamanders are typically found in burrows in the forest floor (Montana

[162] A location chosen by an animal for hibernation.

[163] Breeding range: “The area utilized by an organism during the reproductive phase of its life cycle and during the time that young are reared.” (EPA 2015a)

[164] Riparian: “Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands.” (EPA 2015b)

Field Guide, 2015). Wood frogs use diverse vegetation types from grassy meadows to open forests. After they emerge from dormancy, wood frogs migrate up 900 feet to breeding pools, where they breed rapidly in early spring in permanent or ephemeral water (Homan, Atwood, Dunkle, & Karr, 2010). However, a small percentage of juvenile wood frogs could migrate over 1.5 miles from natal ponds, suggesting juveniles may be capable of migrating relatively long distances (Berven & Grudzien, 1990). Some salamanders and frogs are known to migrate up to 0.25 mile. Mortality and barriers to movement could occur as result of the Proposed Action (Berven & Grudzien, 1990) (Calhoun & DeMaynadier, 2007).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but impacts are expected to be less than significant given the short-term nature and limited geographic scope for 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 Wyoming’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.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and calving grounds for large mammals, such as the elk and moose, has the potential to negatively affect body condition and reproductive success of mammals in Wyoming. For example, moose use certain types of habitats that allow for more effective defense of their calves from predators.

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small scale and impacts are expected to be less than significant. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

Birds

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less suitable habitat and thus reduce survival and reproduction. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, 1997). The majority of FirstNet deployment or operation activities are likely to be small scale in nature. BMPs and mitigation measures as defined through consultation with USFWS, if required, could help to avoid or minimize any potential impacts.

Reptiles and Amphibians

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests. For example, the snapping turtle leaves its breeding pool in the spring and travels to its nesting site Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; no reproductive effects to terrestrial invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species could have a dramatic effect on natural resources. Wyoming has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, or introduction of select plant and aquatic species. However, the state does not have regulations for terrestrial wildlife species.

FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites, although these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers.

Potential invasive species effects to Wyoming's wildlife are described below.

Terrestrial Mammals

In Wyoming, feral swine could adversely impact several native large and small mammals, including bear, turkey, waterfowl, and deer; however, there are currently no established populations in Wyoming (West, Cooper, & Armstrong, 2009). There are populations in neighboring states, so feral swine could become a problem in the future. They feed on reptiles and amphibians, destroy native vegetation resulting in erosion and water resource concerns, and could carry/transmit disease to livestock and humans.

FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites, although these sites are expected to return to their natural state in a year or two. FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations.

Birds

Invasive plant and pest species directly alter the landscape or habitat to a condition that is more favorable for an invasive species, and less favorable for native species and their habitats. For example, in Wyoming, mute swans could impact native waterfowl and wetland birds causing nest abandonment or impacts to rearing young due to their aggressive behavior. Further, this invasive bird could lead to declines in water quality from increased fecal coliform loading in the water, and declines in submerged aquatic vegetation that support native fish and other wildlife (Swift, Clarke, Holevinski, & Cooper, 2013). Although FirstNet deployment activities could result in short-term or temporary changes to specific project sites; these sites are expected to return to their natural state in a year or two. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities.

Reptiles and Amphibians

The red-eared slider (*Trachemys scripta elegans*), an invasive turtle species has been found in Wyoming. This species is highly adaptable and could threaten native wildlife by competing with them for food sources and also spread disease (WGFD, 2015b). 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 from machinery or laborers during deployment operations.

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects in particular pose a large threat to Wyoming's forest and agricultural resources. Species such as the gypsy moth, Asian longhorn beetle, and emerald ash borer are of particular concern in Wyoming 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 (see Chapter 19) could help to avoid or minimize the potential for introducing invasive plant species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure.

Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wildlife resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact wildlife 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 may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g. reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species. 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 individual species as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct 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. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - 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 shore to accept submarine cables could potentially impact wildlife (see Section 18.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/ mortality could occur. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct 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. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.

- 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/or indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 18.4, Radio Frequency Emissions. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - 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 if RF hazards are negligible. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction For a discussion of radio frequency emissions, refer to Section 18.4, Radio Frequency Emissions. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - Deployable Technologies: Implementation of deployable technologies including Cell on Wheels, Cell on Light Truck, or System on Wheels 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. Deployment of drones, balloons, blimps, or 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. Implementation of BMPs and mitigation measures could help 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 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 19, 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, including mowing or limited application of herbicides, may result in less than significant effects to wildlife including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms.

Wildlife resources could 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. Wildlife may also be impacted if increased access leads to an increase in the legal or illegal take of biota. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and therefore, would likely be less than significant given the short-term nature and limited geographic scope for individual activities. Chapter 19, 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 19, 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 19, 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 nationwide, interoperable, public safety broadband network would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wildlife resources as a result of construction and operation of the

Proposed Action. Environmental conditions would therefore be the same as those described in Section 18.1.6.4, Terrestrial Wildlife.

18.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Wyoming are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (USEPA, 2012d).

Based on the impact significance criteria presented in Table 18.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic (human) disturbances may be measurable (although minimal) for some FirstNet projects, individual behavior of fish species would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed. BMPs and mitigation measures could help to avoid or minimize potential impacts to fisheries and aquatic invertebrate population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

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

Depending on the location, construction of new infrastructure and long-term facility maintenance could result in the shoreline habitat alteration in localized areas; in some instances, the permanent loss of riparian vegetation could occur, which could lead to water quality impacts and in turn aquatic habitat alteration. Habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location, depending on the nature of the deployment activity. Additionally, deployment activities with the potential for impacts under the MSFCMA or other sensitive aquatic habitats could be addressed through BMPs and mitigation measures

Indirect Injury/Mortality

Water quality and quantity impacts from exposure to contaminants from accidental spills from vehicles and equipment, and erosion or sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, streams, and other aquatic habitats could result in changes to habitat, food sources, or prey resulting in indirect mortality/injury to fish and aquatic invertebrates. Indirect injury/mortality impacts vary depending on the species, time of year, and duration of deployment. These impacts are expected to be less than significant, and BMPs and mitigation measures to protect water resources (see Section 18.2.4, Water Resources) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. For example, restrictions or alterations to waterways could alter migration patterns, limit fish passage, or affect foraging and spawning site access. Impacts are expected to be less than significant, and are anticipated to be localized and at a small scale, and would vary depending on the species, time of year, and duration of deployment. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal’s ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which 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 expected to be less than significant, and BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive fish within construction zones is non-existant because FirstNet activities would not involve the transport of fish species. The potential to introduce aquatic plants within construction zones, which could impact aquatic habitats, could occur from vehicles and equipment being transported from one region near water to another, or when conducting revegetation of a site near water after deployment activities are complete. FirstNet deployment activities could result in short-term or temporary changes to specific project sites and these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers, therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure.

Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology[165], and the nature and extent of the habitats affected.

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 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 would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to fisheries and aquatic habitats because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have no impact on the aquatic environment.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species

[165] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

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, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; 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 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 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.
  - 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, 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 Emission, for more information on RF emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to fisheries and aquatic habitats. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of 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 of deployment activities and the limited number of aquatic species expected to be impacted. Chapter 19, 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 that might include accidental spills from maintenance equipment or pesticide runoff near fish habitat are anticipated to result in less than significant effects to fisheries and aquatic habitats due to the limited nature of such activities and the likely small quantities of potentially harmful liquids used.

Fisheries and aquatic habitat could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition, the presence of new access roads and transmission line ROWs near water resources that support fish may increase human use of the surrounding areas, which could increase disturbance to fisheries and aquatic habitats resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. Fisheries and aquatic habitat may also be impacted if increased access leads to an increase in the legal or illegal take of biota. However, impacts are expected to be less than significant due to the small scale of expected activities with the potential to affect fisheries and aquatic habitat. As a result of the small scale, only a limited number of individuals are anticipated to be impacted, furthermore, habitat impacts would also be minimal in scale. Chapter 19, 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 19, 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

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 19, 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 nationwide, interoperable, public safety broadband network would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to fisheries and aquatic habitats as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 18.1.6.5, Fisheries and Aquatic Habitats.

18.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Wyoming and Wyoming'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 19, 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 18.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes across the state, the potential impacts to threatened and endangered species addressed below are presented as a range of possible impacts.

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 18.2.6-2, any direct injury or mortality of a listed species at the individual-level could be potentially significant as well as any impact that has more than a negligible potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency. Direct injury/mortality environmental concerns pertaining to federally listed terrestrial mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Wyoming are described below.

Table 18.2.6-2: 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.	
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large-scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

<u>Terrestrial Mammals</u>

Direct mortality or injury to the federally listed species could occur if dens or other habitats of the Canada Lynx (*Lynx Canadensis)*, grizzly bear (*Ursus arctos horribilis)*, Northern long-eared bat (*Myotis septentrionalis)*, or black-footed ferret (*Mustela nigripes)* are present, or if deployment occurs in riparian grassland habitat of the Preble's meadow jumping mouse *(Zapus hudsonius preblei)*. While projects would not likely directly affect the listed mammal species, human disturbance in and around the area could lead to adverse effects to these species as well. Direct mortality or injury to species could occur from vehicle strikes as they are occasionally found along transportation corridors. Entanglement in fences or other barriers could also be a source of mortality or injury to this species. Impacts would likely be isolated, individual events. BMPs to mitigate or reduce potential impacts to federally listed and federal candidate terrestrial mammals are described further below.

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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>Birds</u>

One federally listed bird, the Western yellow-billed cuckoo, is known to occur in Wyoming. 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. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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>Fish</u>

The Kendall Warm Springs Dace is found in one thermal-fed stream located near Green River (Table 18.1.6-5). Direct mortality or injury to this species could occur from vessel/boat strikes or entanglements resulting from the Proposed Action are unlikely as the majority of FirstNet deployment projects would not occur in the aquatic environment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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>Reptiles and Amphibians</u>

One federally listed amphibian, the Wyoming toad, is found in Wyoming. Direct mortality to could occur in construction zones either by excavation activities or by vehicle strikes. Impacts would likely be isolated, individual events. There are no federally listed reptiles in Wyoming.

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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.

Invertebrates

There are no listed invertebrates in Wyoming. Therefore, no direct injury or mortality of federally threatened and endangered invertebrate species is expected as a result of the Proposed Action.

Plants

Direct mortality to federally listed plants, including the Colorado butterfly plant, Ute Ladies' – tresses, blowout penstemon, desert yellowhead, or the whitebark pine, could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. In general, distribution of these species is very limited throughout the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce the breeding success of a listed species either by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which could affect the breeding success. Potential effects to federally listed terrestrial mammals, birds, terrestrial reptiles and marine reptiles, amphibians, fish, and plants with known occurrence in Wyoming 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 in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. Construction activities in the immediate area around a roost tree could startle federally listed bats causing them to abandon their roost tree. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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.

Birds

The Western yellow-billed cuckoo is the only federally listed bird species that are known to nest in Wyoming. The majority of FirstNet deployment activities would not occur Impacts to habitat due to land clearing or excavation activities could directly affect nesting if deployment activities occur during the breeding/nesting season. In addition, habitat loss or degradation could lead to indirect affects to nesting due to birds having to find new nesting sites. Noise, light, or human disturbance within nesting areas could cause Western yellow-billed cuckoos to abandon their nests, relocate to less desirable locations, or cause stress to individuals reducing survival and reproduction. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, resulting from ground disturbing activities could cause stress to the federally listed amphibian, resulting in lower productivity. Land clearing activities, noise, and human disturbance during the critical time periods (e.g., mating, nesting) could lower fitness and productivity. There are no federally list reptiles in Wyoming. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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.

Invertebrates

There are no listed invertebrates in Wyoming. Therefore, no direct injury or mortality of federally threatened and endangered invertebrate species is expected as a result of the Proposed Action.

Fish

Deployment activities in the upstream portions of the Green River could result in increased disturbance (e.g., humans, noise), especially during spawning activity, and changes in water quality could cause stress resulting in lower productivity for the Warm Springs dace (see Section 18.2.4, Water Resources, for a discussion of potential impacts to water resources). Impacts to reproduction for the Warm Springs dace species are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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.

Plants

No reproductive effects to federally listed plants are expected as a result of the Proposed Action as limited herbicides would be used.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered potentially significant.

Potential effects to federally listed terrestrial mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Wyoming are described below.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. Disturbance in stopover, foraging, or breeding areas (visual or noise) or habitat loss/fragmentation 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 adverse effects to federally listed birds. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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.

Reptiles and Amphibians

Habitat loss or alteration, particularly from fragmentation or invasive species, could adversely affect nesting and foraging sites, resulting in reduced survival and productivity; however, disturbances during deployment activities are not anticipated to stress the one federally listed amphibian. There are no federally list reptiles in Wyoming. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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.

Invertebrates

There are no listed invertebrates in Wyoming. Therefore, no behavioral changes of federally threatened and endangered invertebrate species is expected as a result of the Proposed Action.

Fish

Changes in water quality as a result of ground disturbing activities could impact food sources for the Warm Springs dace. Further, increased human disturbance and noise could cause stress causing them to abandon spawning locations or altering migration patterns. Behavioral changes to the Warm Springs dace are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary for geographic extent. FirstNet activities are generally expected to be small-scale in nature, therefore large-scale impacts are not expected; however, it is possible that small-scale changes could lead to potentially significant adverse effects for certain species. For example, impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically.

Land clearing, excavation activities, and other ground disturbing activities in this region of Wyoming could lead to habitat loss or degradation, which could lead to adverse effects depending on the duration, location, and spatial scale of the associated activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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>Birds</u>

Critical habitat has been designated for the Wyoming yellow-billed cuckoo (See Figure 18.1.6-2). Land clearing, excavation activities, and other ground disturbing activities in this region of Wyoming could lead to critical habitat loss or degradation, which could lead to adverse effects depending on the duration, location, and spatial scale of the associated activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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>Reptiles and Amphibians</u>

There are no federally listed reptiles in Wyoming. In addition, no designated critical habitat occurs for amphibian species in Wyoming. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

<u>Fish</u>

There is no designated critical habitat occurs for fish species in Wyoming. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

<u>Plants</u>

Designated critical habitat occurs for the Colorado butterfly plant and desert yellowhead in Wyoming. Therefore, the loss or degradation of designated critical habitat could potentially impact threatened and endangered species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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 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 affect to may affect, but not likely to adversely affect depending on the deployment scenario or site-specific conditions. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Effect

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no effect to threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would have no effect on threatened or endangered species because those activities would not require ground disturbance.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact protected species, it is anticipated that this activity would have no impact on protected species.

Activities with the Potential to Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g. reptiles, mollusks, small mammals, and young), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (e.g., ground-nesting birds). Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Implementation of BMPs and mitigation measures developed through consultation with the appropriate resource agency, 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 right-of-ways (ROWs) or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat to threatened and endangered species. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water could potentially impact threatened and endangered species and their habitat,

particularly aquatic species (see Section 18.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical time periods, reproductive effects and behavioral changes could occur.

  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no impacts to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4 Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are required, impacts could be similar to new wireless construction. Hazards related to security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact threatened and endangered species by direct injury/mortality,

reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. These impacts may affect, but are not likely adversely affect protected species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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 threatened and endangered species that would be affected would depend on the species' phenology and the nature and extent of the habitats affected.

It is anticipated that operational impacts may affect, but are not likely to adversely affect threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect threatened and endangered species, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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 threatened and endangered species associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species through direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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 explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that activities may affect, but are not likely to adversely affect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Chapter 19, 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 effects to threatened and endangered species as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 18.1.6.6, Threatened and Endangered Species.

18.2.7. Land Use, Recreation, and Airspace

18.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Wyoming associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.7.2. 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 18.2.7-1. As described in Section 18.2, 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 18.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with Mitigation Incorporated**	**Less Than Significant**	**No Impact**
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception.	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA
Indirect land use change	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses.	Effect that is potentially significant, but with mitigation is less than significant.	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses.	No conflicts with adjacent existing or planned land uses.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less Than Significant with 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

18.2.7.3. Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of 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 18.2.7-1, 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 above-ground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 18.2.7-1, less than significant impacts would be anticipated as any new land use would be small scale and only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

Access to public or private recreation land or activities could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of ROW or easement. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features. In the long-term, the deployment and installation of poles, towers, structures, or other aboveground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 18.2.7-1, less than significant impacts would be anticipated as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Enjoyment of recreation land could be temporarily impacted by crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 18.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could obstruct navigable airspace depending on the tower location. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 18.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. As drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period of time, FirstNet would not impact airspace resources.

18.2.7.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to land use, recreation, and airspace resources under the conditions described below:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: See *Activities Likely to Have Impacts* below.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on Federal Aviation Regulation (FAR) 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: It is anticipated that there would be no impacts to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*.
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: See *Activities Likely to Have Impacts* below.
    - Recreation: See *Activities Likely to Have Impacts* below.

- Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.

- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
  - Airspace: No impacts are anticipated to airspace form collocation.

- 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 or near bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
  - Land Use: See *Activities Likely to Have Impacts* below.
  - Recreation: See *Activities Likely to Have Impacts* below.
  - Airspace: The installation of cables in or near 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*.

- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
  - Land Use: See *Activities Likely to Have Impacts* below.
  - Recreation: See *Activities Likely to Have Impacts* below.
  - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace*.

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See *Activities Likely to Have Impacts* below.
    - Airspace: See *Activities Likely to Have Impacts* below.

- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: No impacts to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
    - Airspace: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet AGL or do not trigger any of the other FAA obstruction to airspace criteria.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed but would not restrict access to, or enjoyment of, recreational lands.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact airspace because those activities would not result in changes to flight patterns and airspace usage or result in obstructions to airspace.

  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact land use, it is anticipated that this activity would have no impact on land use.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to land use, recreation resources, or airspace as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: No impacts are anticipated – see previous section.

  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) 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 or near bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
    - Land Use: Deployment 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 bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.
- Airspace: No impacts are anticipated – see previous section.

- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.
  - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
  - Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
  - Airspace: No impacts are anticipated – see previous section.

- Wireless Projects
  - New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.
    - Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet AGL or meets other criteria. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight patterns of an airport if the aerial fiber optic plant is located in proximity to one of Wyoming's airports.

  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during

installation, which may cause small reductions in visitation for the duration of installation.
- <u>Airspace:</u> 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.
    - <u>Land Use:</u> No impacts are anticipated – see previous section.
    - <u>Recreation:</u> No impacts are anticipated – see previous section.
    - <u>Airspace:</u> Implementation of deployable aerial communications architecture could result in impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near Wyoming airports. Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, 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.
    - <u>Recreation:</u> 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.
    - <u>Airspace:</u> 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 or results in electromagnetic radiation if in proximity to air navigation facilities and affects navigable airways.

In general, the abovementioned activities could potentially involve construction, including the construction of access roads. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities.

Potential impacts to airspace are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Additionally FirstNet (or its network partners), would prepare, as required, an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. Chapter 19, 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. The degree of change in the visual environment (see Section 18.2.8, Visual Resources)—and therefore the potential indirect impact on a landowner's ability to use or sell of their land as desired—would be highly dependent on the specific deployment location and length of deployment. The use of deployable aerial communications architecture could temporarily add new air traffic or aerial navigation hazards. The magnitude of these effects would depend on the specific location of airborne resources along with the duration of their use. Chapter 19, 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.

18.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use if deployment occurs in areas with compatible land uses. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected however, impacts would be less than significant 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 19, 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 19, 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 18.1.7, Land Use, Recreation, and Airspace.

18.2.8. Visual Resources

18.2.8.1. Introduction

This section describes potential impacts to visual resources in Wyoming associated with deployment and operation of the Proposed Action and Alternative. Chapter 19, 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.

18.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 18.2.8-1. As described in Section 18.2, 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 18.2.8-1: Impact Significance Rating Criteria for Visual Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse change in aesthetic character of scenic resources or viewsheds	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character.	Effect that is potentially significant, but with mitigation is less than significant.	Intermittently noticeable change in aesthetic character that is marginally negative.	No visible effects.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to aesthetic character lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but aesthetics of the area would be returned to original state following the construction and deployment phase.	Transient or no visible effects.
Nighttime lighting	Magnitude or Intensity	Lighting dramatically alters night-sky conditions.	Effect that is potentially significant, but with mitigation is less than significant.	Lighting alters night-sky conditions to a degree that is only intermittently noticeable.	Lighting does not noticeably alter night-sky conditions.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to night-sky conditions lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but lighting would be removed and night-sky conditions would be returned to original state following the construction and deployment phase.	Transient or no visible effects.

18.2.8.3. 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 Wyoming, residents and visitors travel to visit the Yellowstone National Park and other areas around the state for scenic vistas and recreational activities. 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 18.2.8-1, 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 would be considered potentially significant.

Based on the impact significance criteria presented in Table 18.2.8-1, lighting that illuminates the night sky, diminishes night sky viewing over long distances, and persists over the long-term would be considered potentially significant. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience potentially significant impacts to night skies, although potentially minimized to less than significant with implementation of BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented.

18.2.8.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes, and would not require nighttime lightning.
  - 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 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 shore to accept submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur.
- 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 areas.

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 the additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal or 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. Chapter 19, 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 19, 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.

18.2.8.5. 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 potentially be screened or otherwise blocked from view. Chapter 19, 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. These potential impacts would be similar to the potential impacts described for the Deployable Technologies option of the Preferred Alternative, above, only likely with greater numbers of deployable units.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to visual resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 18.1.8, Visual Resources.

18.2.9. Socioeconomics

18.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Wyoming associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 18.2.9-1. As described in Section 18.2, 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 18.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible impact on property values and/or rental fees.	No impacts on real estate in the form of changes to property values or rental fees.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible economic change.	No change to tax revenues, wages, major industries, or direct spending.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated cities/towns.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Impacts to employment	Magnitude or Intensity	High level of job creation at the state or territory level.	Effect that is potentially significant, but with mitigation is less than significant.	Low level of job creation at the state/territory level.	No job creation due to project activities at the state/territory level.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated cities/towns.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes in population number or composition	Magnitude or Intensity	Substantial increases in population, or changes in population composition (age, race, gender).	Effect that is potentially significant, but with mitigation is less than significant.	Minor increases in population or population composition.	No changes in population or population composition.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

18.2.9.3. 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 Revenue;
- 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 reduced property values due to below average public safety communication services. Improved services would reduce response times and improve responses. These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Existing Environment, property values vary considerably across Wyoming. Median values of owner-occupied housing units in the 2009–2013 period in the 10 largest population concentrations ranged from over $568,000 in the greater Jackson area, followed by $202,000 in the Green River area to just under $151,000 in the Riverton 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 Revenue

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's partner(s) may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

FirstNet may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment is a direct, beneficial impact of expenditures on FirstNet. Additional, indirect employment increases would occur as additional businesses hire workers to provide supporting goods and services. For instance, FirstNet's partner(s) and their subcontractors and vendors would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and less than significant. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary across Wyoming. The average unemployment rate in 2014 was 4.3 percent, considerably lower than the national rate of 6.2 percent. All counties in Wyoming had unemployment rates below the national average (that is, better employment performance).

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 18.2.9-1 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 could 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.

18.2.9.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. These effect are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 18.2.9-1.

Activities Likely to Have No Impacts

- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact socioeconomics, it is anticipated that this activity would have no impact on socioeconomic resources.

Activities with the Potential to Have Impacts

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below indicates which of the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate
- Changes to Spending, Income, Industries, and Public Revenues
- Impacts to Employment
- Changes in Population Number or Composition

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
    - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near 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., parked vehicles in new parking lots), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant.
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts:
        - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
        - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

In general, the abovementioned activities would have less than significant beneficial socioeconomic impacts. To the extent that certain activities could have adverse impacts to property values, those impacts are also expected to be less than significant as described above. Chapter 19, 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

Activities with the Potential to Have Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. As with deployment activities, all operational activities would have socioeconomic impacts, because all represent economic activity. All operational activities would be conducted by public or private sector employees, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity, and not significant across the entire state, they are measurable socioeconomic impacts.

Potential socioeconomic impacts would primarily be beneficial, and generally of these types:

- Changes to Spending, Income, Industries, and Public Revenues – Operational activities would require expenditures, which then generate business income and employee wages, and may result in new public sector revenues such as taxes on sales and income. All such effects would be small in scale relative to the regional and state economy; their impacts would be less than significant.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would be less than significant as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the state. Chapter 19, 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.

18.2.9.5. 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. The potential impacts are anticipated to be less than significant as described above. Chapter 19, 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, becuase they are small individually, overall impacts would be less than significant.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be less than significant as they would be limited to a relatively small number of sites within the region and District. Chapter 19, 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 18.1.9, Socioeconomics.

18.2.10. Environmental Justice

18.2.10.1. Introduction

This section describes potential impacts to environmental justice in Wyoming associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 18.2.10-1. As described in Section 18.2, 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 18.2.10-1: 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

18.2.10.3. Description of Environmental Concerns

Effects associated with other Resource Areas that have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment" (CEQ, 1997). Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). See Socioeconomics Environmental Consequences for additional discussion. The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. Indian tribes are considered environmental justice populations (CEQ, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both* "adverse" and "disproportionately high" in their incidence on environmental justice populations relative to the general population (CEQ, 1997). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences.

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deploys projects, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this PEIS. The areas shown in the environmental justice screening map of Existing Environment (Section 18.1.10.4) as having moderate or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 18.1.10.3, Environmental Setting: Minority and Low-Income Populations, the percentage of All Minorities in the Wyoming population is lower than that of the region, and considerably lower than that of the nation. The state has considerably lower rates of poverty than the region or the nation. The relatively few areas with environmental justice populations are fairly evenly distributed across the state. They occur within the population concentrations and in the sparsely populated regions of the state. Areas with moderate potential for environmental justice populations are larger in number and area and are also fairly evenly distributed across Wyoming. Further analysis using the data developed for the screening analysis in Section 18.1.10.4, 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, 2015h; USEPA, 2016e).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts can use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

18.2.10.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand holes, pulling vaults, junction boxes, huts, and points of presence (POP) structures. Activities at these small entry points would be limited and temporary and thus are not likely to produce perceptible changes

affecting any surrounding communities. Therefore, they would not affect environmental justice communities.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and therefore would have no impacts to environmental justice. If physical access is required to light dark fiber, it would likely be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts on environmental justice communities.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance, impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice communities, it is anticipated that this activity would have no impact on environmental justice issues.

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 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 generate temporarily 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 or near bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing facilities such as

staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore to accept submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than significant, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level. Chapter 19, 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 19, 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.

18.2.10.5. 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 19, 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 19, 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 18.1.10, Environmental Justice.

18.2.11. Cultural Resources

18.2.11.1. Introduction

This section describes potential impacts to cultural resources in Wyoming associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.11.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 18.2.11-1. As described in Section 18.2, 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 18.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect[1]**	**Effect, but Not Adverse**	**No Effect**
Physical damage to and/or destruction of historic properties[2]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
	Geographic Extent	Direct effects Area of Potential Effect (APE).		Direct effects APE.	Direct effects APE.
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties.		Permanent direct effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
Indirect effects to historic properties (i.e. visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a contributing or non-contributing portion of a single or many historic properties.	No indirect effects to historic properties.
	Geographic Extent	Indirect effects APE.		Indirect effects APE.	Indirect effects APE.
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties.		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties.	No indirect effects to historic properties.
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct or indirect effects to historic properties.
	Geographic Extent	Direct and/or indirect effects APE.		Direct and/or indirect effects APE.	Direct and/or indirect effects APE.

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	Mitigated Adverse Effect[1]	Effect, but Not Adverse	No Effect
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties.		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties.	No direct or indirect effects to historic properties.
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No segregation or loss of access to historic properties.
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties.		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties.	No segregation or loss of access to historic properties.
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties.		Infrequent, temporary, or short-term changes in access to a single or many historic properties.	No segregation or loss of access to historic properties.

[1] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/THPO and other consulting parties, including Indian tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[2] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

18.2.11.3. 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 18.2.11-1, 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 Wyoming, some deployment activities may be in these areas, in which case BMPs (see below) would help avoid or minimize the potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of potentially significant impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alter historic architectural features. Significant impacts such as these could be avoided or minimized through BMPs (see Chapter 19).

Loss of Access to Historic Properties

The deployment of equipment requiring a secure area has the potential to cause the loss of access to historic properties. The highest potential for this type of significant impact would be from the deployment of equipment in secure areas that impact the access to sites of cultural importance to American Indians. It is anticipated that FirstNet would identify potential impacts to such areas through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

18.2.11.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to cultural. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual change.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water could impact cultural resources as shorelines and creekbeds in Wyoming have the potential to contain archaeological sites. Impacts to cultural resources could also potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cable, which could result in the disturbance of archaeological sites (archaeological deposits tend to be associated with bodies of water and have high probabilities for archaeological deposits), and the associated structures could have visual effects on historic properties.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.
- Wireless Projects

- New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in the disturbance of archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas such as Wyoming City 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 19, 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 effect but would not likely adversely effect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 19, 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.

18.2.11.5. 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 19, 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 19, 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 18.1.11, Cultural Resources.

18.2.12. Air Quality

18.2.12.1. Introduction

This section describes potential impacts to Wyoming's air quality from deployment and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Wyoming's air quality were evaluated using the significance criteria presented in Table 18.2.12-1. As described in Section 18.2, 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 Wyoming's air quality addressed in this section are presented as a range of possible impacts.

Table 18.2.12-1: Impact Significance Rating Criteria for Air Quality

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased air emissions	Magnitude or Intensity	Pollutant concentrations would exceed one or more NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would cause an area to be out of attainment for any NAAQS. Projects do not conform to the SIP covering nonattainment and maintenance areas.	Effect that is potentially significant, but with mitigation is less than significant.	Negligible emissions would occur for any criteria pollutants within an attainment area but would not cause a NAAQS exceedance.	Action would not cause pollutant concentrations to exceed the NAAQS in nonattainment and maintenance areas. Emissions in attainment areas would not cause air quality to go out of attainment for any NAAQS. Projects are *de minimis* or conform to the SIP covering nonattainment and maintenance areas.
	Geographic Extent/Context	NA		NA	NA
	Duration or Frequency	Permanent or long-term.		Short term	Temporary

NA = Not Applicable

18.2.12.3. 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 and Wyoming Ambient Air Quality Standards. Areas exist in Wyoming that are in maintenance or nonattainment for one or more of the following pollutants: PM_{10} and O_3 (Table 18.1.12-4) (Figure 18.1.12-1) (See Section 18.1.12, Air Quality).

Based on the significance criteria presented in Table 18.2.12-1, 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 Wyoming; however, NAAQS and Wyoming Ambient Air Quality Standards exceedances are not anticipated. Given that nonattainment areas are present throughout Wyoming (Figure 18.1.12-1), 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.

18.2.12.4. Potential Impacts of the Preferred Alternative

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

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Activities associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit. Gaining access to the conduit and installing the cable may result in minor disturbance at entry and exit points, however this activity would be temporary and infrequent, and is not expected to produce any perceptible changes in air emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions to air quality because it would create no new sources of emissions.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant concentrations of criteria pollutants would be emitted during installment of this equipment from the use of machinery. Deployment and operation of satellite-enabled devices and portable equipment are expected to have minimal to no impact on ambient air quality concentrations.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, it is anticipated that this activity would have no impact on those resources.

Activities with Potential Impacts to Air Quality

Construction, deployment, and operation activities related to the Preferred Alternative could impact air quality by generating various quantities of criteria and air pollutant emissions. It is expected that such impacts would be less than significant due to the shorter duration and localized nature of the activities. The types of infrastructure deployment 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 or near 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 the additional power units, structural hardening, and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
  - Deployable Technologies: The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be less than significant due to the limited nature of the deployment. Chapter 19, 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 19, 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.

18.2.12.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows:

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The concentrations and associated impacts would be dictated by the products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact on ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

18.2.13. Noise

18.2.13.1. Introduction

This section describes potential noise impacts in Wyoming associated with construction, deployment, and operation of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 18.2.13-1. As described in Section 18.2, 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 Wyoming addressed in this section are presented as a range of possible impacts.

Table 18.2.13-1: 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 exceed 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.

18.2.13.3. Description of Environmental Concerns

Increased Noise Levels

The Proposed Action has the potential to generate noise during construction and operation of various equipment used for deployment. These noise levels could be above what is typically generated in a given area and may alter the ambient acoustical environment. If significant, the noise could cause impacts on residential areas, or other facilities that are sensitive to noise, such as churches, hospitals, or schools. The construction activities for deploying some of the various equipment evaluated under the Proposed Action could cause short-term impacts to nearby populations. However, it is likely that there would be less long-term effects from operational use of the proposed equipment.

Based on the significance criteria presented in Table 18.2.13-1, 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.

18.2.13.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise impacts and while others would not.

In addition, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects

  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment 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 increased 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 or near bodies of water could generate noise if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be less than significant due to the temporary duration of deployment activities. Additionally, pre-existing noise levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). Chapter 19, 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 for routine maintenance and inspection of the facilities because of the temporary nature of the activities which would not create new permanent sources of noise. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be similar to or less than those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections or onsite generator use occurs, potential noise impacts could result as explained above. Chapter 19, 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.

18.2.13.5. 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 19, 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. However, once these operations cease, noise levels would quickly return to baseline levels. Chapter 19, 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 on ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

18.2.14. Climate Change

18.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Wyoming associated with deployment and operation of the Proposed Action and Alternatives.

Chapter 19, 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.

18.2.14.2. 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 18.2.14-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to climate and climate change-vulnerable resources addressed in this section are presented as a range of possible impacts.

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or alternatives. The second is the implications and possible effects of climate change on the environmental consequences of the Proposed Action or alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or alternatives (CEQ, 2014).

CEQ has established the significance criteria for GHG emissions at 25,000 MT CO_2e on an annual basis, with the requirement that if projected emissions exceed this threshold, a GHG emissions quantitative analysis is warranted (CEQ, 2014). Although 25,000 MT is a very small fraction (one 266,920th) of the total U.S. emissions of 6,673 MMT in 2013 (USEPA, 2015t), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the proposed action is more general. In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2014). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process can provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 18.2.14-1: Impact Significance Rating Criteria for Climate

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Contribution to climate change through GHG emissions	Magnitude or Intensity	Exceedance of 25,000 metric tons of CO_2e/year, and global level effects observed.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No increase in greenhouse gas emissions or related changes to the climate as a result of project activities.
	Geographic Extent	Global impacts observed.		Global impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No measurable impact of climate change on FirstNet installations or infrastructure.
	Geographic Extent	Local and regional impacts observed.		Local and regional impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA

NA = Not Applicable

18.2.14.3. Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. For an average of seven days per year, maximum temperatures reach more than about 95 °F in the Northern Plains. These high temperatures are projected to occur much more frequently with days over 100 °F projected to double in number in the Northern Plains even under a low emissions scenario. Increases are also expected in the number of nights with minimum temperatures higher than 60 °F in the north part of the plains. These increases in extreme heat will have many negative consequences, including increases in surface water losses, heat stress, and demand for air conditioning. (USGCRP, 2014a)

Air Temperature

Figure 18.2.14-1 and Figure 18.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Wyoming from a 1969 to 1971 baseline.

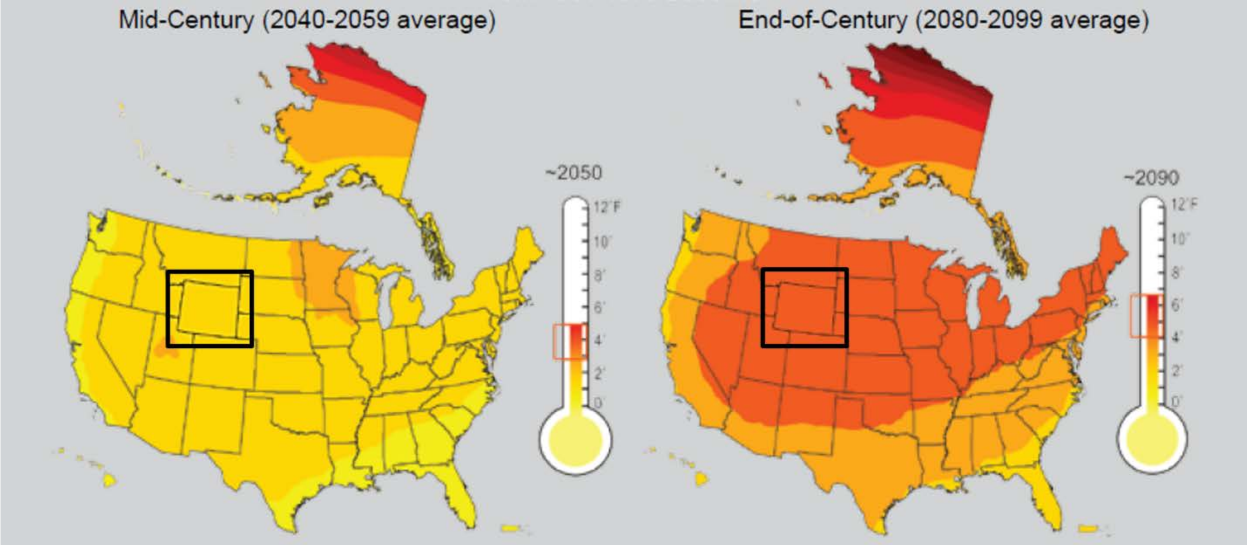
Bsk – Figure 18.2.14-1 shows that by mid-century (2040 to 2059), temperatures in Wyoming under a low emissions scenario would increase by approximately 4 °F, and by the end of the century (2080 to 2099) under a low emissions scenario temperatures in Wyoming would increase by approximately 6° F. (USGCRP, 2009)

Figure 18.2.14-2 shows that under a high emissions scenario for the period (2040 to 2059), temperatures would increase by approximately 5 °F. Under a high emissions scenario for the period (2080 to 2099) in the Bsk region of Wyoming, temperatures would increase by approximately 10 °F in the southwestern portion of the region and by 9 °F in other portions of the region. (USGCRP, 2009)

BWk – Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) under a low emissions scenario at the same rate as the Bsk region. (USGCRP, 2009)

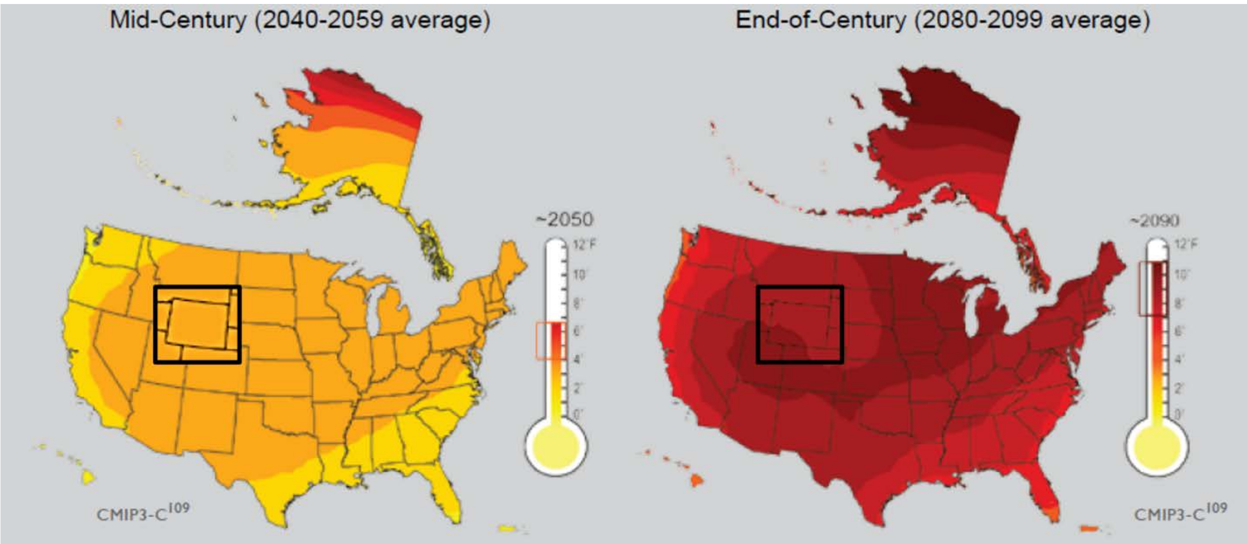
Dfb – Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Bsk region under a low and high emissions scenario. (USGCRP, 2009)

Dfc – Temperatures in this region are expected to increase by mid-and-end century at the same rate as the BWk region under both a low emissions and high emissions scenario. (USGCRP, 2009)



Source: (USGCRP, 2009)

Figure 18.2.14-1: Wyoming Low Emission Scenario Projected Temperature Change



Source: (USGCRP, 2009)

Figure 18.2.14-2: Wyoming High Emission Scenario Projected Temperature Change

Precipitation

Winter and spring precipitation is projected to increase in the northern states of the Great Plains region relative to a 1971-2000 average. In central areas, changes are projected to be small relative to natural variations. Projected changes in summer and fall precipitation are also small except for summer drying in the central Great Plains. The number of days with heavy precipitation is expected to increase by mid-century, especially in the Northern Plains. (USGCRP, 2014a)

Total seasonal snowfall has generally increased in the northern Great Plains although snow is melting earlier in the year and more precipitation is falling as rain versus snow. Overall snow cover has decreased in the Northern Hemisphere, due in part to higher temperatures that shorten the time snow spends on the ground. (USGCRP, 2014c)

In much of eastern Wyoming, there is an expected decrease in the number of consecutive dry days under a low emissions scenarios by mid-century (2041 to 2070) as compared to the period (1971 – 2000). Under a high emissions scenario in a majority of Wyoming there is a projected increase in the number of consecutive dry days. An increase in consecutive dry days could lead to drought. (USGCRP, 2014a)

Figure 18.2.14-4 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 18.2.14-3 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050. (USGCRP, 2014b)

Figure 18.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. (Note: white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability.) (USGCRP, 2014b)

Bsk - Figure 18.2.14-3 shows that in a low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent in some portions of the region while there are no anticipated changes in other areas of the region in winter and summer. In spring, precipitation is expected to increase by 10 percent in this scenario. There are no expected increases in precipitation in fall other than fluctuations due to natural variability. (USGCRP, 2014b)

Figure 18.2.14-4 shows that if emissions continue to increase, winter precipitation could increase more than 30 percent over the period 2071 to 2099 in some areas of the Bsk region while in other sections of the region precipitation may increase up to 30 percent or 20 percent. In spring, precipitation in this scenario could increase 10, 20, or 30 percent depending on the area of the region. Precipitation in summer is expected to decrease 10 percent or have no changes depending on the portion of the region. No significant change to fall precipitation is anticipated over the same period. (USGCRP, 2014b)

BWk – Precipitation in winter and spring for the BWk region under a low emissions scenario is expected to increase by 10 percent. No significant changes to summer or fall precipitation are anticipated. (USGCRP, 2014b)

Under a high emissions scenario, winter precipitation is expected to increase 20 percent. In spring, precipitation is expected to increase 20 to 30 percent depending on the portion of the region. Precipitation in summer is expected to decrease 10 percent. No significant changes to fall precipitation are anticipated in the BWk region. (USGCRP, 2014b)

Dfb – Under a low emissions scenario in winter, spring and summer, precipitation is expected to increase by 10 percent in some areas of the Dfb region while in other areas there are no anticipated changes to precipitation. In fall, there are no expected changes to precipitation. (USGCRP, 2014b)

In winter, precipitation is expected to increase 20 or 30 percent depending on the portion of the Dfb region under a high emissions scenario. Precipitation is expected to increase 10 or 20 percent in spring depending on the area of the region. In summer, precipitation is anticipated to decrease 10 percent in some areas of the Dfb region, and in other areas of the region there are no anticipated changes to summer precipitation. There are no expected increases in precipitation in fall other than fluctuations from natural variability. (USGCRP, 2014b)

Dfc – Under a low emissions scenario, temperatures are projected to increase at the same rate as the BWk region. (USGCRP, 2014b)

Under a high emissions scenario, winter precipitation is expected to increase 20 to 30 percent depending on the area of the region. In spring, precipitation is expected to increase 20 percent. Precipitation in summer is anticipated to decrease 10 percent. There are no expected increases in precipitation in fall other than fluctuations due to natural variability. (USGCRP, 2014b)

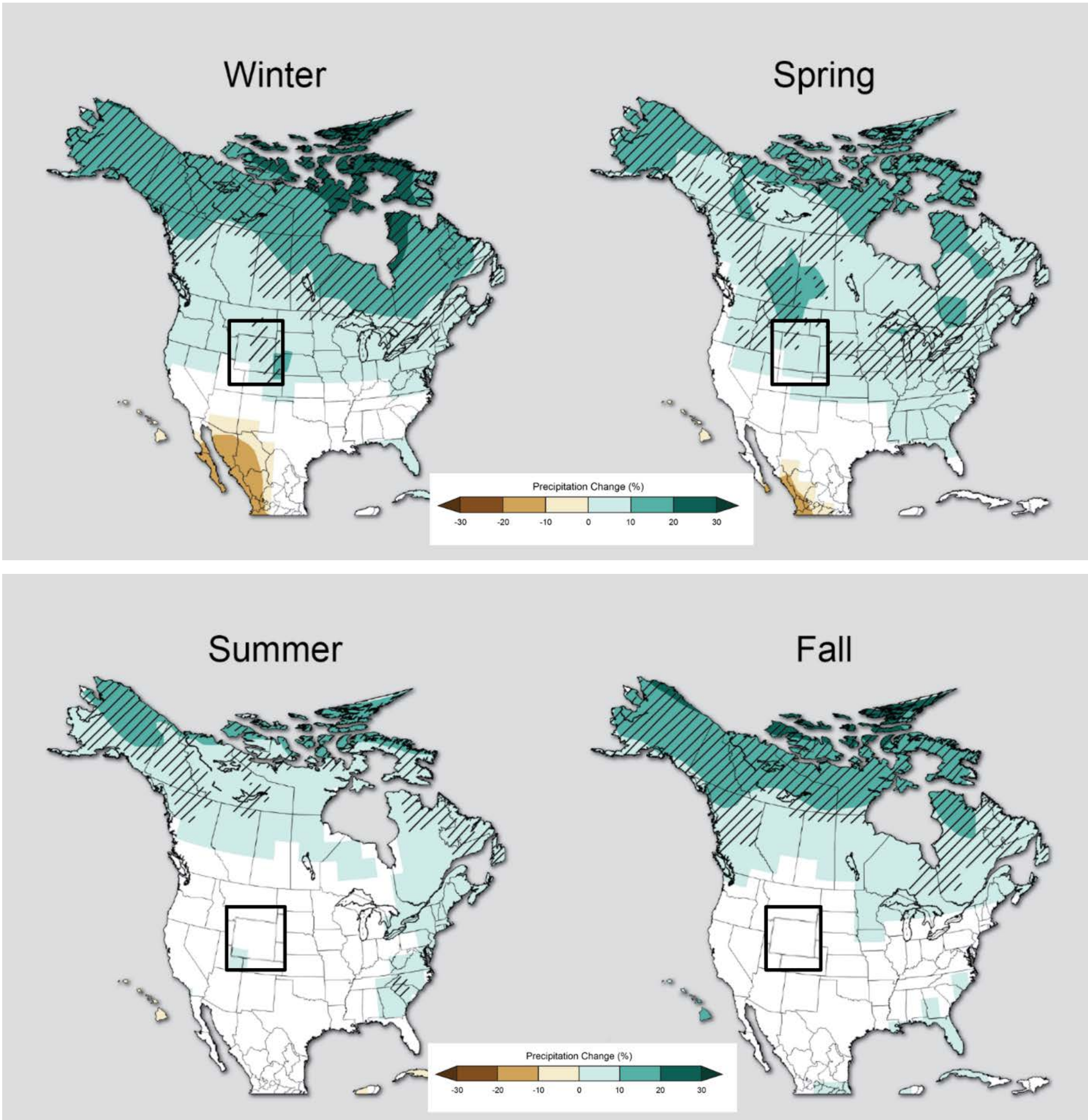
Severe Weather Events

It is difficult to forecast the impact of climate change on severe weather events such as winter storms and thunderstorms. Trends in thunderstorms 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. 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, 2014c)

18.2.14.4. Description of Environmental Concerns

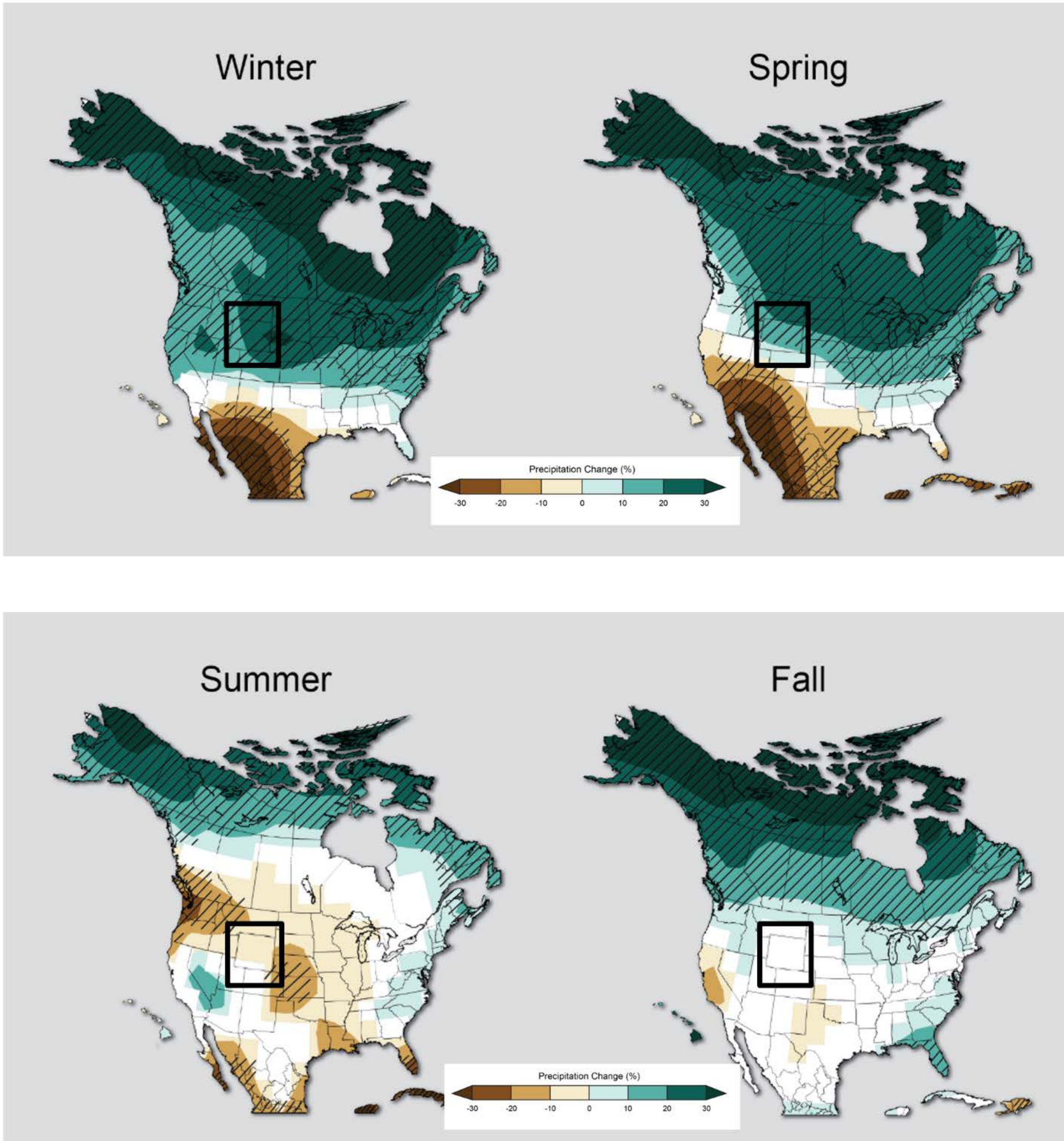
Greenhouse Gas Emissions

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.



Source: (USGCRP, 2014b)

Figure 18.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario



Source: (USGCRP, 2014b)

Figure 18.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Based on the impact significance criteria presented in Table 18.2.14-1, 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, 2015g). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO_2/day. Running continuously, the tower would cause the emission of 446 MT of CO_2 per year.

However, grid-provided electricity would result in less CO_2 emissions than on-site provided energy. Using the average carbon intensity of grid-provided electricity of 1,136.53 lbs/MWh (USEPA, 2015v), the same transmitter would be responsible for approximately 271 MT of CO_2 per year running continuously. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Furthermore, the components of the system would not necessarily all be this large, running all the time, or at full power. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Vereecken, et al., 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Other Resource Areas and FirstNet Projects

Climate change may increase project-related impacts by magnifying or otherwise altering impacts in other resources areas. For example climate change may impact air quality, water resource availability, and recreation. These effects would vary from state to state depending on the resources in question and their relationship to climate change. These impacts will be considered fully in Chapter 18, Cumulative Impacts. No BMPs will be described for this aspect of the resource.

The severity and length of droughts is expected to increase in Wyoming as snow pack is reduced and temperatures rise. This in turn may contribute to more frequent and larger wildland fires (USGCRP, 2014c) as well as increased fuel load in the form of dead trees caused by invasive bark beetles (USFS, 2015l). Climate change is expected to have profound impacts on Wyoming's ecosystems, particularly in protected areas such as Yellowstone National Park. These impacts include disturbance to forest habitats, changes in the hydrologic cycle, changes in fire regimes, and other disturbances that may permanently alter the habitat and recreational opportunities in these areas (NPS, 2015r).

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.

Wildland fires may present a risk to both permanent and mobile installations and first responders, as well as ecosystems. Extended periods of extreme heat may increase general demand on the electric grid (DOE, 2015), impede the operation of the grid, and overwhelm the capacity on-site equipment needed to keep microwave and other transmitters cool. The anticipated increase in wildland fires due to drought (USGCRP, 2014d) may also present a risk to both permanent and mobile installations as well as to first responders themselves. Increases in the frequency of extreme rainfall events may impact infrastructure located in or near floodplains and flood flood-prone areas (USGCRP, 2014c).

18.2.14.5. 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 Wyoming, including deployment and operation activities.

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

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions

    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions.
- Satellites and Other Technologies
    - Satellite Enabled Devices and Equipment: The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create any perceptible changes in GHG emissions because they would not create any new emissions sources.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

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:

- Wireless Projects
    - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
    - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
    - Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities.
    - New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small marine sources would contribute to GHGs.
    - Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions

- Wireless Projects
    - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with construction as construction would not take place. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
- Deployable Technologies
    - COWs, COLTs, or SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However, this would be highly dependent on their size, number, and the frequency and duration of their use.

      Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of piloted or unmanned aircraft were used for a sustained period of time (i.e. months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be less than significant due to the limited and localized nature of deployment activities. Chapter 19, 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.

18.2.14.6. 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.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term.

Potential Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could produce emissions as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The concentrations and associated impacts would be dictated by the products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations. These activities are expected to be less than significant due to the limited duration of deployment activities.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. Climate change effects have the most noticeable impacts over a long period of time. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of the deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to GHG emissions or climate as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 18.1.14.

18.2.15. Human Health and Safety

18.2.15.1. Introduction

This section describes potential impacts to human health and safety in Wyoming associated with deployment of the Proposed Action and Alternatives. Chapter 19, 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.

18.2.15.2. 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 18.2.15-1. As described in Section 18.2, 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 18.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

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
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Toxic Substances Control Act (TSCA), Emergency Planning and Community Right to Know Act (EPCRA).	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory)		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural and Manmade Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

NA = Not Applicable

18.2.15.3. 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 18.2.15-1, occupational injury impacts could be potentially significant if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites. For example, if fuel is spilled from an onsite fuel tank, the spilled fuel could migrate down gradient and infiltrate underground drinking water sources. The general public may then be exposed to hazardous chemicals in their drinking water if they utilize the same groundwater aquifer.

To protect occupational workers, the 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, 2015c).

1.) Engineering controls;

2.) Work practice controls;

3.) Administrative controls; and

4.) Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes,[166] 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

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[166] Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents. (OSHA, 2016b)

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, 2015c). To the extent practicable, FirstNet partner(s) would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets (SDS) describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all FirstNet project sites. In addition to HASPs and SDSs, standard operating procedures (SOP) would be developed and implemented by FirstNet partner(s) for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear step-wise directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (OSHA, 2015c). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks, and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE is the common term used to refer to the equipment worn by employees to minimize exposure to chemical and physical hazards. Examples of PPE include gloves, protective footwear, eye protection, protective hearing devices (earplugs, muffs), hard hats, fall protection, respirators, and full body suits. PPE is the last line of defense to prevent occupational injuries and exposure (OSHA, 2015c).

The WYOSHA is authorized by OSHA to administer a state program to oversee employee safety in public or private sector workplaces. Therefore, the WYOSHA defers all regulatory authority and enforcement for occupational safety relating to FirstNet site work to the leadership and interpretation of OSHA.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination and mine lands at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed as a result of site activities. Mines may cause unstable surface and subsurface conditions as a result of underground shaft collapses or seismic shifting. Based on the impact significance criteria presented in Table 18.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties or abandoned or active mine lands. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination and/or mining activities using federal resources such as the USEPA Cleanups in My Community database and U.S. Department of Interior's Abandoned Mine Lands inventory, through the WDEQ, 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 observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and applicable Wyoming state laws in order to protect workers and the general public from direct exposure or fugitive contamination.

Exposure assessments identify relevant site characteristics, temporal exposure parameters, and toxicity data to determine the likelihood of adverse health effects. More formally known as a human health risk assessment (HHRA), these studies provide mathematical justification for implementing controls at the site to protect human health. If the HHRA determines the potential for adverse health effects is too great, Wyoming may require FirstNet to perform environmental clean-up actions at the site to lower the existing levels of contamination. HHRAs help determine which level of PPE (i.e., Level D, Level C, Level B, or Level A) is necessary for a work activity. HHRAs take into account all exposure pathways: absorption, ingestion, inhalation, and injection. Therefore, specific protective measures (e.g., controls and PPE) that disrupt the exposure pathways could be identified, prioritized, and implemented.

Natural and Manmade Disasters

FirstNet is intended to improve connectivity among public safety entities during disasters, thereby improving their ability to respond more safely and effectively during such events. The addition of towers, structures, facilities, equipment, and other deployment activities is expected to allow for expedited responses during natural and manmade disasters. The impacts of natural and manmade disasters are likely to present unique health and safety hazards, as well as exacerbate pre-existing hazards, such as degrading occupational work conditions and disturbing existing environmental contamination. The unique hazards presented by natural and manmade disasters may include, fire, weather incidents (e.g., floods, tornadoes, hurricanes, etc.), earthquakes, vandalism, large- or small-scale chemical releases, utility disruption, community evacuations, or any other event that abruptly and drastically denudes the availability or quality of transportation infrastructure, utility infrastructure, medical infrastructure, and sanitation infrastructure. Additionally, such natural and manmade disasters could directly impact public safety communication infrastructure assets through damage or destruction.

Based on the impact significance criteria presented in Table 18.2.15-1, human health impacts could be significant if FirstNet deployment sites are located in areas that are directly impacted by natural and manmade disasters that could lead to exposure to hazardous wastes, hazardous materials, and occupational hazards. FirstNet's emphasis on public safety-grade communications infrastructure may result in a less than significant beneficial impact, as new infrastructure could be deployed with additional structural hardening, and existing infrastructure may also be hardened as appropriate and feasible, in an effort to reduce the possibility of infrastructure damage or destruction to some degree.

Potential mitigation measures for natural disasters is to be aware of current weather forecasts, forest fire activities, seismic activities, and other news worthy events that may indicate upcoming disaster conditions. Awareness provides time and opportunity to plan evacuation routes, to relocate critical equipment and parts, and to schedule appropriate work activities preceding and after the natural disaster. These mitigation steps reduce the presence of workers and dangerous work activities to reduce the potential for injury or death. Manmade disasters could be more difficult to anticipate due to the unexpected or accidental nature of the disaster. Though some manmade disasters are due to malicious intentions, many manmade disasters result from human error or equipment failure. The incidence of manmade disasters affecting FirstNet deployment sites would be difficult to predict and diminish because the source of such disasters is most likely to originate from sources independent of FirstNet activities. Therefore, FirstNet partner(s) would develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

18.2.15.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: the pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to human health and safety because there would be no ground disturbance or heaving 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 ROW, 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 ROW. 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, managing 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, 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 – Submarine Fiber Optic Plant: The installation of fiber optic cables in or near bodies of water requires workers to operate over aquatic and/or marine environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shore to accept submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, managing 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 project 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, managing 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, managing 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 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, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human

health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments ROW, work over water, and environmental contamination), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure and release of hazardous chemicals and hazardous waste, and release of historic contamination to the surrounding environment. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. Chapter 19, 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, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. Chapter 19, 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.

18.2.15.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source is an electrical generator, then there would also likely be a need to manage hazardous materials (fuel) onsite. These activities could result in less than significant impacts to human health and safety. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. Chapter 19, 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, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures may be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. These impacts would be less than significant because of the small scale of likely FirstNet activities; activities associated would routine maintenance, inspection, and deployment of deployable technologies would be temporary and often of limited duration. Chapter 19, 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 18.1.15. Human Health and Safety.

WY APPENDIX A – BIOLOGICAL RESOURCES

Table A1. Priority Habitats for Conservation in Wyoming

Vegetative Community Type	EPA Ecoregion(s)	Description	Distribution
Aspen/ Deciduous Forests	Rocky Mountains and Great Plains	Habitat dominated by aspen, bur oak *(Quercus macrocarpa)*, gambel oak, or bigtooth maple *(Acer grandidentatum).*	Large range from pure upland to riparian in western and far northeastern Wyoming.
Cliff/Canyon/ Cave/Rock Outcrops	Rocky Mountains and Great Plains	Cliffs, canyons and rock outcrops.	Common in the mountainous West.
Desert Shrublands	Great Plains	Dry basins with poorly developed soils and less than 10 inches of annual precipitation.	Middle of the state at elevations between 4,980 and 7,220 feet.
Foothills Shrublands	Rocky Mountains and Great Plains	Mixed mountain shrubs comprised of diverse plant communities and shrub species.	Foothills of Western Wyoming.
Montane/ Subalpine Forests	Rocky Mountains	Douglas fir at lower elevations, lodgepole pine at mid-elevations, and Engelmann spruce, sub-alpine fir, and whitebark pine *(Pinus albicaulis*) at higher elevations.	Northwestern Wyoming generally above 7,000 feet where moisture, temperature, and nutrient conditions are sufficient for tree seedling establishment.
Mountain Grasslands and Alpine Tundra	Rocky Mountains	Grasslands in montane landscapes typically above 6,500 to 7,000 feet and alpine areas above timberline.	Northern, Middle, and Southern Rocky Mountains.
Prairie Grasslands	Great Plains	Shortgrass prairie dominated by buffalo grass and blue grama and mixed-grass prairie dominated by needle-and-thread grass, western wheatgrass, blue grama, Sandberg's bluegrass *(Poa secunda),* prairie Junegrass *(Koeleria macrantha),* upland sedges *(Carex spp.),* and Indian ricegrass *(Oryzopsis hymenoides).*	Below 7,000 feet predominantly in the east and in basins of south central and southwest.
Riparian Areas	Rocky Mountains and Great Plains	Lands immediately adjacent creeks, streams, and rivers.	Wide distribution adjacent to creeks, streams, and rivers throughout the state.
Sagebrush Shrublands	Great Plains	Sagebrush ecosystems have a high proportion of annual precipitation occurring in the winter as snow or as early spring rain. Sagebrush stands vary from large patches dominated by a single species to a mix of sagebrush and other shrubs.	Wide distribution in cold, semi-desert climates across the Intermountain West.
Wetlands	Rocky Mountains and Great Plains	Habitats where the soil is annually saturated with water or covered by water at some time during the growing season including wet meadows, potholes, playas, oxbows, beave ponds, marshes, bogs, seeps, vegetated shorelines of	Throughout the state, but limited due to lack of precipitation.

		lakes and ponds, and other types of open water.	
Xeric and Lower Montane Forests	Rocky Mountains and Great Plains	Ponderosa pine and limber pine/juniper systems of conifer woodlands.	Northeastern Wyoming.

Source: (WGFD 2010)

ACRONYMS

Acronym	Definition
A.D.	Anno Domini
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ACT	Advanced Communications Technology, Inc.
AGL	Above Ground Level
AML	Abandoned Mine Lands
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act
ASL	Above Sea Level
ATC	Air Traffic Control
ATO	Air Traffic Organization
ATV	All-terrain vehicle
B.C.	Before Christ
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
BTU	British thermal unit
CAA	Clean Air Act
CCC	Civilian Conservation Corps
CDC	Center for Disease Control and Prevention
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Controlled Firing Area
CFOI	Census of Fatal Occupational Injuries
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH_4	Methane
CIMC	Cleanups In My Community
CIO	Chief Information Officer
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLT	Cell on Light Truck
COW	Cell on Wheels
CRS	Community Rating System
CWA	Clean Water Act

Acronym	Definition
D.C.	District of Columbia
DoD	Department of Defense
DOE	Department of Energy
DTE	Dubois Telephone Exchange, Inc.
EFH	Essential Fish Habitat
EIA	Energy Information Administration
EMS	Emergency Medical Services
EO	Executive Order
EPCRA	Emergency Planning and Community Right to Know Act
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FLM	Federal Land Manager
FLPMA	Federal Land Policy Management Act
FR	Federal Register
FRA	Federal Railway Administration
FSDO	Flight Standards District Office
FSS	Flight Service Station
GAO	Government Accountability Office
GHG	Greenhouse Gas
GNIS	Geographic Names Information System
GOHS	Governor’s Office of Homeland Security
GWP	Global Warming Potential
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutants
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IBA	Important Bird Area
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel on Climate Change
ITU	International Telecommunication Union
JAC	Jackson Hole Airport
LBS	Locations-Based Services
LID	Low Impact Development
LLC	Limited Liability Company
LMR	Land Mobile Radio

Acronym	Definition
LRR	Land Resource Regions
LTE	Long Term Evolution
MBTA	Migratory Bird Treaty Act
MHI	Median Household Income
MHz	Megahertz
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tonnes
MOA	Military Operation Area
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MT	Metric Ton
MTR	Military Training Route
MYA	Million Years Ago
N_2O	Nitrous Oxide
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	National Airspace System
NASAO	National Association of State Aviation Officials
NCED	National Conservation Easement Database
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGL	Network Generation Lifeline
NHL	National Historic Landmark
NHP	Natural Heritage Program
NHPA	National Historic Preservation Act
NIST	National Institute of Standards and Technology
NM	Nautical Miles
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notices to Airmen
NO_X	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	Nationwide Public Safety Broadband Network
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places

Acronym	Definition
NSA	National Security Areas
NTFI	National Task Force on Interoperability
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
NWP	Nationwide Permit
NWR	National Wildlife Refuge
NWS	National Weather Service
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OHV	Off-Highway Vehicle
OSHA	Occupational Safety and Health Administration
PEIS	Programmatic Environmental Impact Statement
PGA	Peak Ground Acceleration
PL	Public Law
PM	Particulate Matter
POP	Point of Presence
PPE	Personal Protective Equipment
PSC	Public Service Commission
PSCC	Public Safety Communications Commission
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PTA	Pōhakuloa Training Area
RAS	Rockies Audubon Society
RCRA	Resource Conservation and Recovery Act
REC	rural electric cooperative
RF	Radio Frequency
ROW	Right-of-way
RT	Range Telephone
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SF_6	Sulfur Hexafluoride
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_3	Sulfur Trioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedure

Acronym	Definition
SOW	Site on Wheels
SO_X	Sulfur Oxides
SPL	Sound Pressure Level
SSA	Sole Source Aquifer
STATSGO2	State Soil Geographic
SUA	Special Use Airspace
SWAP	State Wildlife Action Plan
SWPPP	Stormwater Pollution Prevention Plan
TCT	Tri County Telephone
TFR	Temporary Flight Restriction
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
U.S.	United States
U.S.C.	U.S. Code
UA	Unmanned Aircraft
UAS	Unmanned Aerial Systems
UCA	Utah Communications Authority
UHF	Ultra High Frequency
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFA	U.S. Fire Administration
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compound
W.S.	Wyoming Statute
WAQSR	Wyoming Air Quality Standards and Regulations
WCS	Wetlands Classification Standard
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WHP	Wyoming Highway Patrol
WOHS	Wyoming Office of Homeland Security

Acronym	Definition
WONDER	Center for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research
WRDS	Water Resources Data System
WWDC	Wyoming Water Development Commission
WWI	World War I
WWII	World War II
WYDOH	Wyoming Department of Health
WYDOT	Wyoming Department of Transportation
WYDWS	Wyoming Department of Workforce Services
WYNDD	Wyoming Natural Diversity Database
WYOSHA	Wyoming Occupational Safety and Health Administration

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