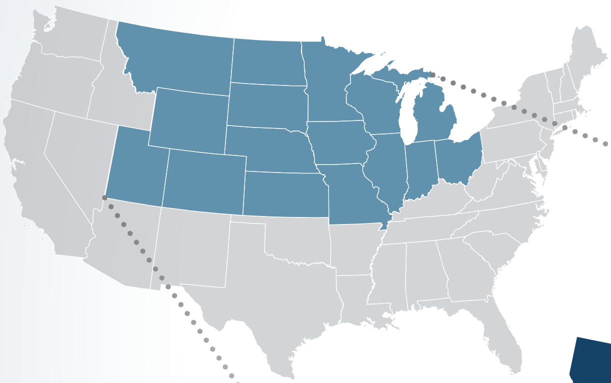
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Central United States

VOLUME 14 - CHAPTER 16



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First Responder Network Authority

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Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Central United States

VOLUME 14 - CHAPTER 16

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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
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16.UTAH

American Indian tribes with a rich cultural history lived in what is now Utah for centuries before the 1600s. Spanish friars looking for new routes between California and Texas, and seeking to spread Christianity to indigenous peoples, were likely the first Europeans to pass through Utah. The area remained largely settled by indigenous peoples until 1847 when Mormons came to the Salt Lake Valley looking for religious sanctuary. Utah became a state in 1896 (State of Utah, 2015a). Utah is bordered by Idaho and Wyoming to the north, Nevada to the west, Arizona to the south, and Colorado to the east. This chapter provides details about the existing environment of Utah as it relates to the Proposed Action.

General facts about Utah are provided below:

- **State Nickname**: The Beehive State
- **Land Area:** 82,170 square miles; **U.S. Rank**: 12 (U.S. Census Bureau, 2010)
- **Capital:** Salt Lake City
- **Counties:** 29 (U.S. Census Bureau, 2015a)
- **2014 Estimated Population:** Over 2.9 million people; **U.S. Rank:** 33 (U.S. Census Bureau, 2015b)
- **Most Populated Cites:** Salt Lake City, West Valley City, and Provo (U.S. Census Bureau, 2015a)
- **Main Rivers:** Colorado River, Sevier River, San Juan River, and Green River
- **Bordering Waterbodies:** None
- **Mountain Ranges:** Wasatch Mountains, Uinta Mountains, and a portion of the Rocky Mountains
- **Highest Point:** Kings Peak (13,520 ft) (USGS, 2015i)

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16.1. AFFECTED ENVIRONMENT

16.1.1. Infrastructure

16.1.1.1. Definition of the Resource

This section provides information on key Utah 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, ports, harbors 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 16.1.1.3 provides an overview of the traffic and transportation infrastructure in Utah, including road and rail networks and airport facilities. Utah public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (Public Law [Pub. L.] No. 112-96, Title VI Stat. 156 (codified at 47 United States Code [U.S.C.] 1401 et seq.) (the Act), including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by the Act. Public safety services in Utah are presented in more detail in Section 16.1.1.4. Section 16.1.1.5 describes specific public safety communications infrastructure and commercial telecommunications infrastructure in Utah. An overview of utilities in Utah, such as power, water, and sewer, are presented in Section 16.1.1.6.

16.1.1.2. Specific Regulatory Considerations

Multiple Utah laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 16.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state's applicable statutes and administrative rules referenced in column one. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

Table 16.1.1-1: Relevant Utah Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Utah Code: Title 53 Public Safety	Department of Public Safety	Engages in emergency planning activities, including preparation of policy and procedure and rulemaking necessary for implementation of the federal Emergency Planning and Community Right to Know Act of 1986.

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

State Law/Regulation	Regulatory Agency	Applicability
Utah Code: Title 54 Public Service Commission	Public Utilities Commission	Defines public utility as "every railroad corporation, gas corporation, electrical corporation, distribution electrical cooperative, wholesale electrical cooperative, telephone corporation, telegraph corporation, water corporation, sewerage corporation, heat corporation, and independent energy producer, where the service is performed for, or the commodity delivered to, the public generally, or in the case of a gas corporation or electrical corporation where the gas or electricity is sold or furnished to any member or consumers within the state for domestic, commercial, or industrial use."
Utah Code: Title 41 Motor Vehicles; Title 56 Railroads	Department of Transportation	Maintain, and operates railroads situated wholly or partly within or without this state and any branch or branches of such railroads.
Utah Code: Title 19 Environmental Quality	Department of Natural Resources	Governs the design, construction, operation, and maintenance of public water systems; protects watersheds and water sources used for public water systems.

16.1.1.3. Transportation

This section describes the traffic and transportation infrastructure in Utah, 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 Utah are based on a review of maps, aerial photography, and federal and state data sources.

The Utah Department of Transportation (UDOT) has jurisdiction over freeways and major roads, airports, railroads, and mass transit in the state; local counties have jurisdiction for smaller streets and roads. The mission of the UDOT is "innovating transportation solutions that strengthen Utah's economy and enhance quality of life" (UDOT, 2015a).

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

- 46,254 miles of public roads (FHWA, 2014) and 3,014 bridges (FHWA, 2015a);
- 1,343 miles of freight rail network, 368 of which are shared with passenger railroad operations (UDOT, 2015b); and
- 152 aviation facilities, including airstrips and heliports (FAA, 2016a).

Road Networks

As identified in Figure 16.1.1-1, the major urban center of the state is Salt Lake City-Provo-Orem in the northwest. Utah has four 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 roads. Table 16.1.1-2 lists the interstates and their start/end points in Utah. Per the national standard, even numbered interstates run from west to east with the lowest numbers beginning in the south; odd numbered interstates run from north to south with the lowest numbers beginning in the west (FHWA, 2015b).

Table 16.1.1-2: Utah Interstates

Interstate	Southern or Western Terminus in UT	Northern or Eastern Terminus in UT
I-15	AZ line at St. George	ID line near Portage
I-70	I-15 near Cove Fort	CO line at Cisco
I-80	NV line at Wendover	WY line at Evanston
I-84	I-80 at Echo	ID line near Snowville
I-215	I-80 near Woodridge Terrace	I-15 near North Salt Lake

Source: (FHWA, 2015b)

In addition to the Interstate System, Utah 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).

National Scenic Byways are roads with nationwide interest; the byways are designated and managed by the U.S. Department of Transportation’s Federal Highway Administration. Utah has eight National Scenic Byways (FHWA, 2015c):

- Dinosaur Diamond Prehistoric Highway,
- The Energy Loop: Huntington/Eccles Canyons Scenic Byway,
- Flaming Gorge-Uintas National Scenic Byway,
- Logan Canyon Scenic Byway,
- Nebo Loop Scenic Byway,
- Scenic Byway 12,
- Scenic Byway 143 – Utah’s Patchwork Parkway, and
- Trail of the Ancients.

State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by UDOT. Some State Scenic Byways may be designated on portions of National Scenic Byways. Utah has 19 State Scenic Byways that crisscross the entire state (Table 16.1.8-5, Visual Resources Section) (Utah Office of Tourism, 2016f).[2]

Figure 16.1.1-1 illustrates the major roadways in Utah. Section 16.1.8, Visual Resources, describes the National and State Scenic Byways found in Utah from an aesthetic perspective.

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

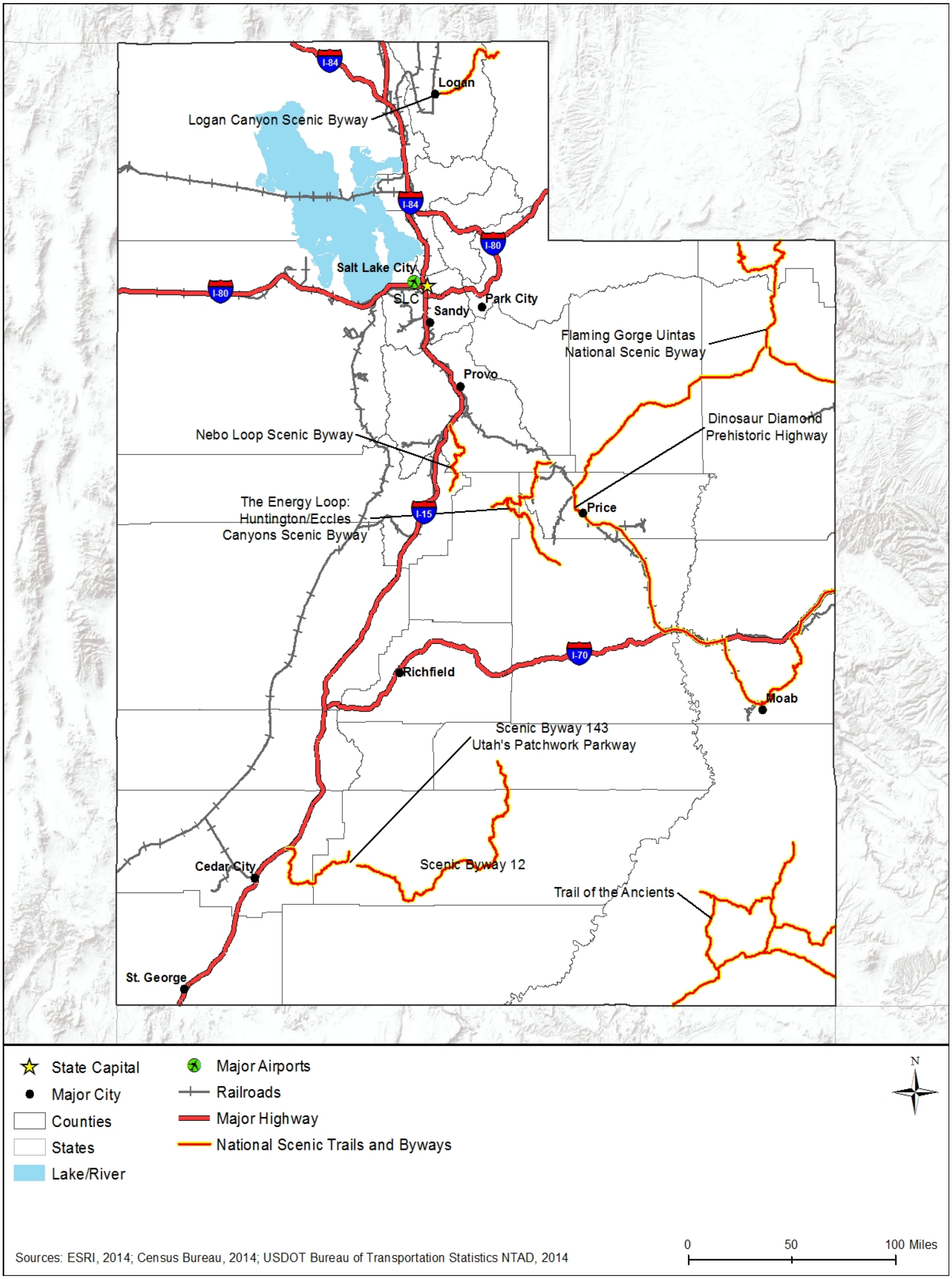


Figure 16.1.1-1: Utah Transportation Networks

Airports

Air service to the state is provided by Salt Lake City International Airport (SLC), a major international airport. SLC is operated by the Salt Lake City Department of Airports and is five miles to the northwest of downtown Salt Lake City (SLC, 2015a). SLC is the 27th busiest airport in North America and 80th in the world for the number of passengers served (SLC, 2015b). In 2015, the airport served 22,152,498 passengers, facilitated 311,859 aircraft operations, and offered about 315 daily departures (Salt Lake City International Airport, 2016) (SLC, 2015b).

Rail Networks

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

Amtrak runs one line through Utah: the California Zephyr. The California Zephyr runs daily between Chicago and San Francisco Bay area, cuts across central Utah, and includes stops in Price, Provo, and Salt Lake City. Covering 2,447 miles, it is Amtrak's longest route (Amtrak, 2014). In 2013, Amtrak served 55,283 passengers in Utah (UDOT, 2015b). Table 16.1.1-3 describes the line that runs through Utah.

Table 16.1.1-3: Amtrak Train Routes Serving Utah

Route	Starting Point	Ending Point	Length of Trip	Cities Served in Utah
California Zephyr	Chicago, IL	Emeryville, CA	51 hours 20 minutes	Green River, Helper, Provo, Salt Lake City

Source: (Amtrak, 2015)

The Utah Transit Authority (UTA) serves the Salt Lake City metropolitan area with FrontRunner commuter rail, TRAX light rail, and streetcar services. UTA operates on 88 miles of track and served 3,437,925 passengers in 2013, which includes all three rail services plus bus service (UDOT, 2015b). "FrontRunner commuter rail operates on 88 miles of track across one line that runs north-south to connect the counties of Salt Lake, Davis, Weber, and Utah counties" (UTA, 2015a). "TRAX light rail has three lines that run throughout Salt Lake County and the S-Line streetcar operates on one line in South Salt Lake" (UTA, 2015b). Due to the high concentration of Utah's population in the Salt Lake City metropolitan area, 75 percent of Utah's population has a passenger rail station, Amtrak or FrontRunner, within 30 miles of their home (UDOT, 2015b).

Freight rail companies own and operate 1,343 miles of track in Utah (UDOT, 2015b). The Federal Railroad Administration (FRA) classifies railroads as Class I, Class II, or Class III based on corporate revenue thresholds (FRA 2015a). Two Class I railroads operate in the state: Union Pacific (UP) and BNSF Railway (UDOT, 2015b). The UP owns and operates on 1,249 miles of track in Utah, while BNSF operates on 433 miles of track in the state (UDOT, 2015b). In addition, nine Class III railroads operate in Utah (UDOT, 2015b). In 2011, 59.7 million tons of freight traveled by freight rail in Utah (UDOT, 2015b).

Harbors and Ports

There are no major commercial harbors or ports in Utah. Marinas and small boat harbors are located in Great Salt Lake, Utah Lake, Lake Powell, as well as along other smaller lakes and rivers throughout the state. Marinas along Great Salt Lake are Great Salt Lake State Marina and Antelope Island, along the southeastern shore of the lake (StateParks, 2015b). The Utah Lake Marina is on the lake's eastern shore, where the Provo River meets the lake (StateParks, 2015a). Northern Lake Powell marinas include the Bullfrog Marina and Halls Crossing Marina (Lake Powell Resorts and Marinas, 2016).

16.1.1.4. Public Safety Services

Utah public safety services generally consist of public safety infrastructure and first responder personnel aligned with the demographics of the state. Table 16.1.1-4 presents Utah's key demographics including estimated population; households; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 16.1.9, Socioeconomics; however, these demographics are key to understanding the breadth of public safety services throughout the state.

Table 16.1.1-4: Key Utah Indicators

Utah Indicators	
Estimated Population (2014)	2,942,902
Land Area (square miles) (2010)	82,170
Population Density (persons per sq. mile) (2010)	33.6
Municipal Governments (2007)	242

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

Table 16.1.1-5 presents Utah's public safety infrastructure, including fire and rescue stations, law enforcement facilities, and fire departments. Table 16.1.1-6 identifies first responder personnel including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 16.1.1-5: Public Safety Infrastructure in Utah by Type

Infrastructure Type	Number
Fire and Rescue Stations [a]	335
Law Enforcement Agencies [b]	136
Fire Departments [c]	196

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

[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.

Table 16.1.1-6: First Responder Personnel in Utah by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers [a]	540
Fire and Rescue Personnel [b]	6,303
Law Enforcement Personnel [c]	8,237
Emergency Medical Technicians and Paramedics [d, e]	2,260

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

[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.

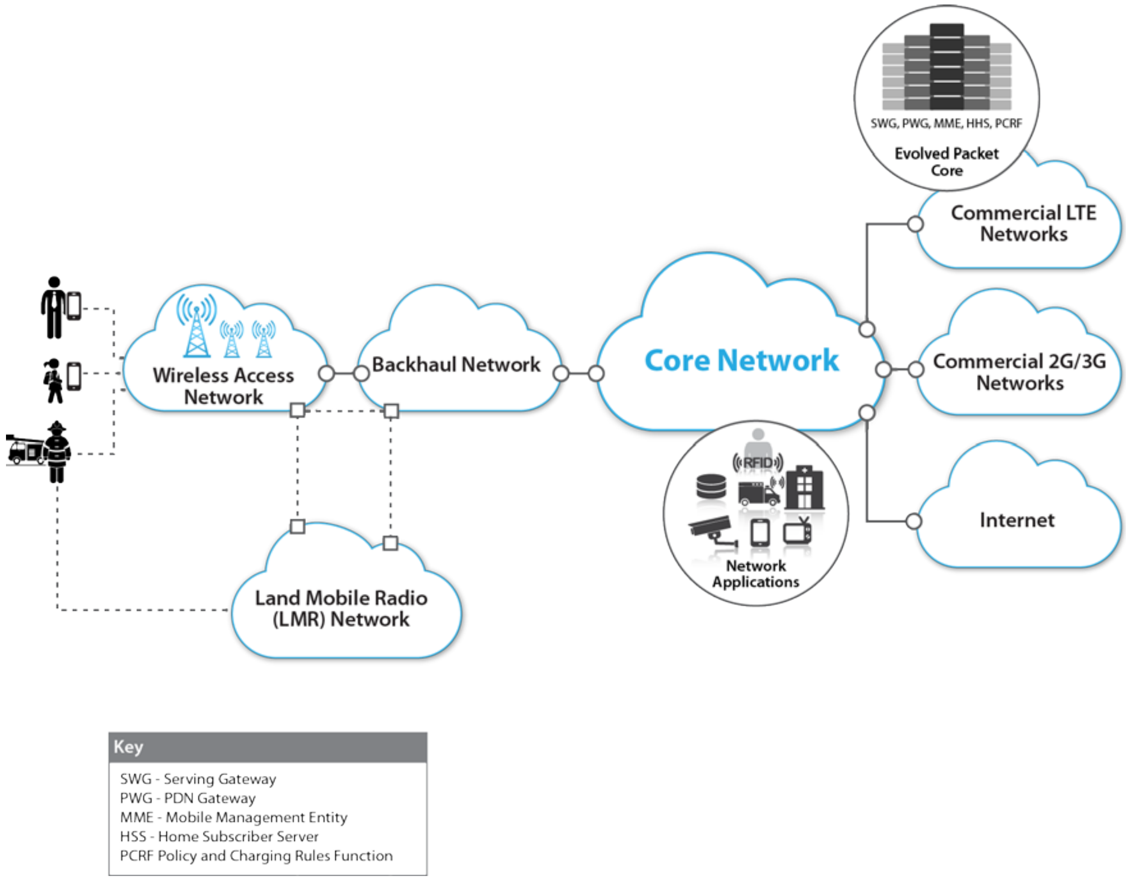
[d] BLS Occupation Code: 29-2041

[e] All BLS data collected in 2015.

16.1.1.5. Telecommunications Resources

There is no central repository of information for public safety communications infrastructure and commercial telecommunications infrastructure; 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 16.1.1-2 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.



Prepared by: Booz Allen Hamilton

Figure 16.1.1-2: 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 2.1.1), has the potential to provide users with better coverage, while offering additional capacity and enabling the use of new applications that would likely make their work safer and more efficient. Designing such a network presents several challenges due to the uniqueness of the deployment, the requirements, and the nationwide scale (NIST, 2015) Historically, there have been many challenges and impediments to timely and effective sharing of information. 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 in Utah.

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 Public Safety Communications Research (PSCR) prepared a locations-based services (LBS) research and development roadmap to examine the current state of location-based technologies. The program also forecasts the evolution of LBS capabilities and gaps, and 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).

Utah's public safety LMR network environment is facing transition and reflects the challenges of meeting the need for greater system capabilities, broader coverage (especially at 800 MHz), and technology modernization to broadband and fuller data capability delivery (UCA, 2014). In July 2014, the Utah Communications Authority (UCA) assumed control of the Utah Communications Agency Network operating at Very High Frequency (VHF)[3] and 800 MHz which is the statewide network servicing public safety users (RadioReference.com, 2015a).

Statewide/Multi-County Public Safety Networks

The UCA operates the Public Safety LMR statewide network which also connects with WyoLink, the statewide network of its neighboring state Wyoming (RadioReference.com, 2015a). UCN is a combination analog legacy VHF network supplemented by 800 MHz (both conventional and trunked)[4]; Figure 16.1.1-3 below depicts VHF coverage with

Figure 16.1.1-4 and Figure 16.1.1-5 showing Utah's conventional and trunked 800 MHz coverage, respectively (UCA, 2015). In a 2014 legislative report, the UCA recommended: continued upgrades and maintenance of the VHF network as 800 MHz Project 25 (P25) infrastructure[5] is deployed; migration to Phase 2 P25[6] technology in 800MHz where economically feasible; a need for increased handheld coverage for both VHF and 800 MHz; and reevaluation of the necessity of maintaining VHF as the state implements its LMR network modernization (UCA, 2014).

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

[4] An LMR trunked radio system is one that links together multiple conventional radios using computer control; this use of data connectivity allows for up to 100 subscribers per channel (National Public Safety Telecommunications Council, 2012).

[5] 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.

[6] Phase 2 P25 technology uses Time Division Multiple Access (TDMA) versus the current Phase 1 Frequency Division Multiple Access (FDMA) currently in use for Utah's 800 MHz trunked system.

Utah statewide Common/Shared public safety communications operate on VHF (155MHz) and 800 MHz with the VHF frequency supporting all agencies including police, fire marshal, search and rescue, civil defense, and EMS. 800 MHz is used to provide extended coverage/repeater capability (RadioReference.com, 2015b). UCA's VHF system provides broad-based geographic coverage in Utah as Figure 16.1.1-3 illustrates below (UCA, 2015). Conventional (analog) 800 MHz coverage provides less geographical coverage in Utah versus the trunked or linked 800 MHz systems in the state. The comparison of Figure 16.1.1-4 and Figure 16.1.1-5 demonstrate this below (UCA, 2015).

County/City Public Safety Networks

Counties and cities in Utah are able to subscribe to the state's UCA network; however this participation is optional and many legacy analog VHF and Ultra High Frequency (UHF)[7] public safety systems continue to be used in Utah (UCA, 2014). For example, in Salt Lake County most public safety communications traffic resides on Utah's Statewide Network with additional use of VHF for dispatch, and tactical communications for Fire/EMS (RadioReference.com, 2015c). There continues to be diverse usage of VHF and UHF conventional (analog) legacy LMR networks in Salt Lake County such as Salt Lake City Fire Dispatch's use of VHF and the city of Alta's use of VHF system for all city services (RadioReference.com, 2015c).

In Provo, the county seat of Utah County, most county and city public safety traffic is carried on the UCA network. However, cities and town within the county continue to rely on VHF and UHF systems for diverse needs including: VHF in the city of Springville for fire department paging, and in the city of Woodland Hills as a Backup/Repeater; and UHF in the city of Provo for hospital communications (RadioReference.com, 2015d). In rural Daggett County, the UCA system is available with local public safety communications supported primarily by VHF including EMS services and the Sheriff (shared with Utah Highway Patrol (UHP); as well as the local law enforcement channel which employs UHF and is shared with the UHP in Daggett County as well (RadioReference.com, 2015e).

Public Safety Answering Points (PSAPs)

According to the Federal Communication Commission's (FCC) Master PSAP registry there are 61 PSAPs in Utah serving Utah's 29 counties as of March 22, 2016 (FCC, 2015a).

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

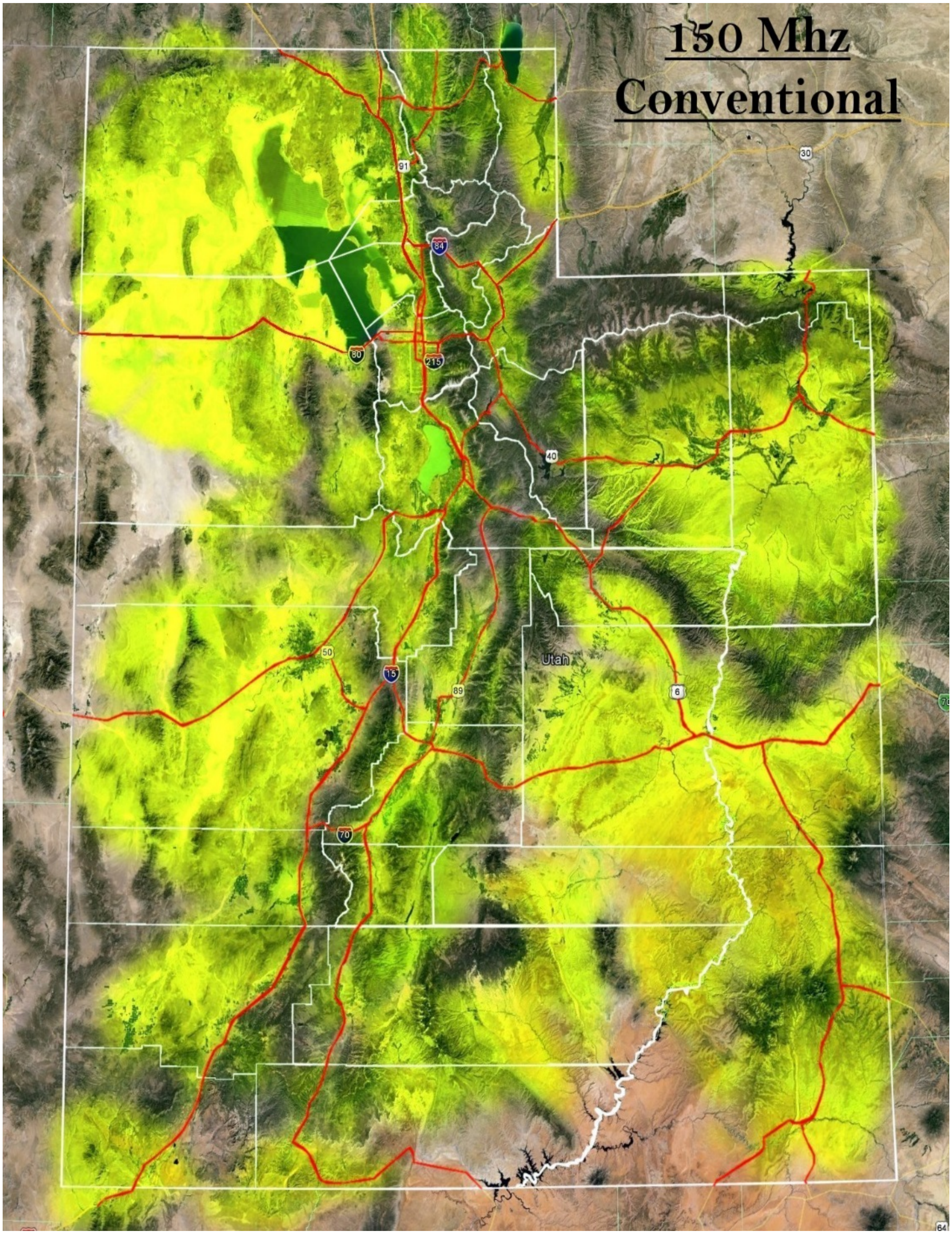


Figure 16.1.1-3: Utah's Communications Authority Statewide VHF Coverage Map

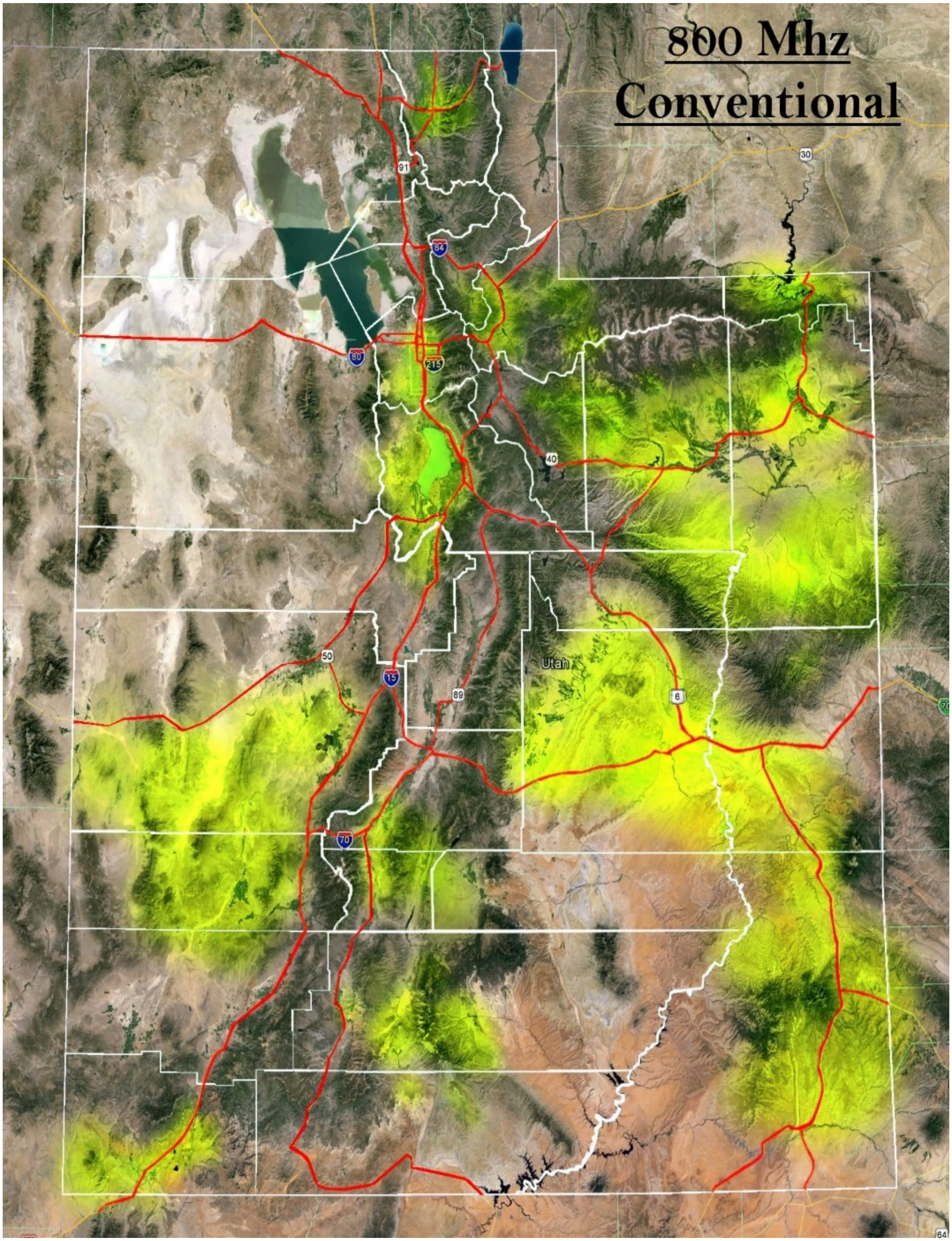


Figure 16.1.1-4: Utah Communication Authority 800 Conventional MHz Coverage

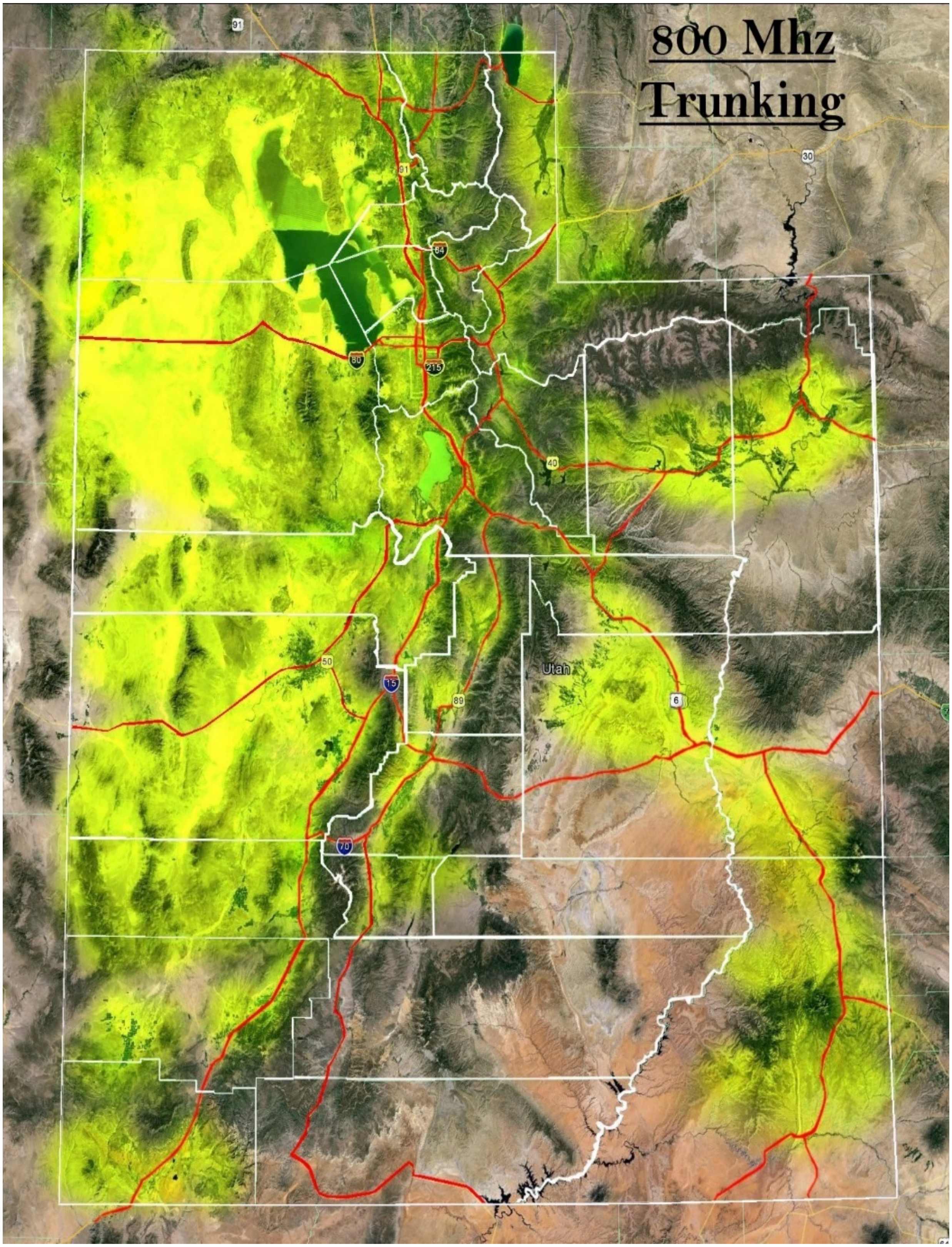


Figure 16.1.1-5: Utah Communication Authority 800 Trunked MHz Coverage

Utah also operates a trunked radio system using the P25 Phase 2 technology that ties together multiple convention radios, which leverages digital data connectivity and accommodates up to 100 subscribers per channel (National Public Safety Telecommunications Council, 2012)**.**

Commercial Telecommunications Infrastructure

Utah'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 Utah'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

Utah's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks, including coaxial cable, fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems. Table 16.1.1-7 presents the number of providers of switched access[8] lines, Internet access,[9] and mobile wireless services including coverage.

Table 16.1.1-7: Telecommunications Access Providers and Coverage

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access line [a]	121	97.9% of households
Internet access [b]	50	66% of households
Mobile wireless [c]	9	85% of population

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

[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 16.1.1.5, Last Mile Fiber Assets.

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

[9] Internet access includes Digital Subscriber Line (DSL), cable modem, fiber, satellite, and fixed wireless providers.

Table 16.1.1-8 shows the wireless providers in Utah along with their geographic coverage. Figure 16.1.1-6, Figure 16.1.1-7, Figure 16.1.1-8, and Figure 16.1.1-9 show: the combined coverage for the top two providers; Sprint and T-Mobile's coverage; Vivint Wireless, NTUA Wireless, Strata Networks, and Digis coverage; and the coverage of all other providers with less than 5 percent coverage area, respectively.[10]

Table 16.1.1-8: Wireless Telecommunications Coverage by Providers

Wireless Telecommunications Providers	Coverage
AT&T Mobility LLC	78.986%
Verizon Wireless	49.271%
Sprint	14.395%
T-Mobile	7.745%
Vivint Wireless	7.564%
NTUA Wireless	6.423%
Strata Networks	5.784%
Digis	5.253%
Other[a]	13.74%

Source: (NTIA, 2014)
[a] Other: Provider with less than 5% coverage area. Providers include: Cricket Wireless; SKYVIEW-TECHNOLOGIES; InfoWest, Inc.; River Canyon Wireless; South Central Utah Telephone Association, Inc.; Utah Broadband; Keystone KS Internet Service; Breakaway Wireless; Connext LLC; Beeline Digital; NeboNet; Beehive Broadband; Catapulsion Blue Spring Broadband; SenaWave; The Blue Zone, LLC; Myvocom; Neighborhood ISP; Webwave Internet Services LLC; I Web Conn; High Speed Utah; All West Communications, Inc.

[10] 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 "[State Name] Other Fiber Providers". All Wireless providers were mapped as well; those with areas under 5% were merged and mapped as "[State Name] Other Wireless Providers". Providers under 5% were denoted in their respective tables.

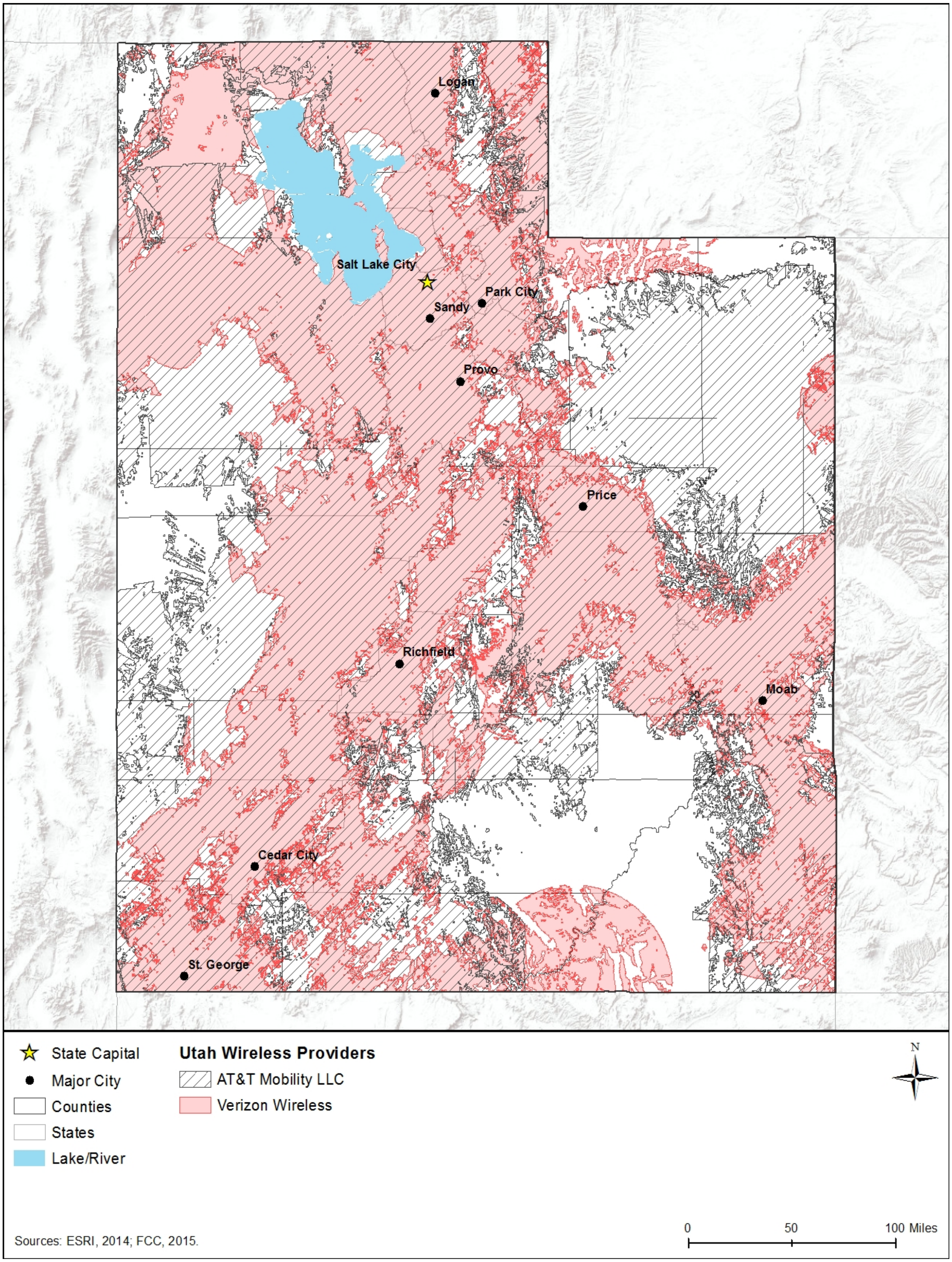


Figure 16.1.1-6: AT&T and Verizon Wireless Availability in Utah

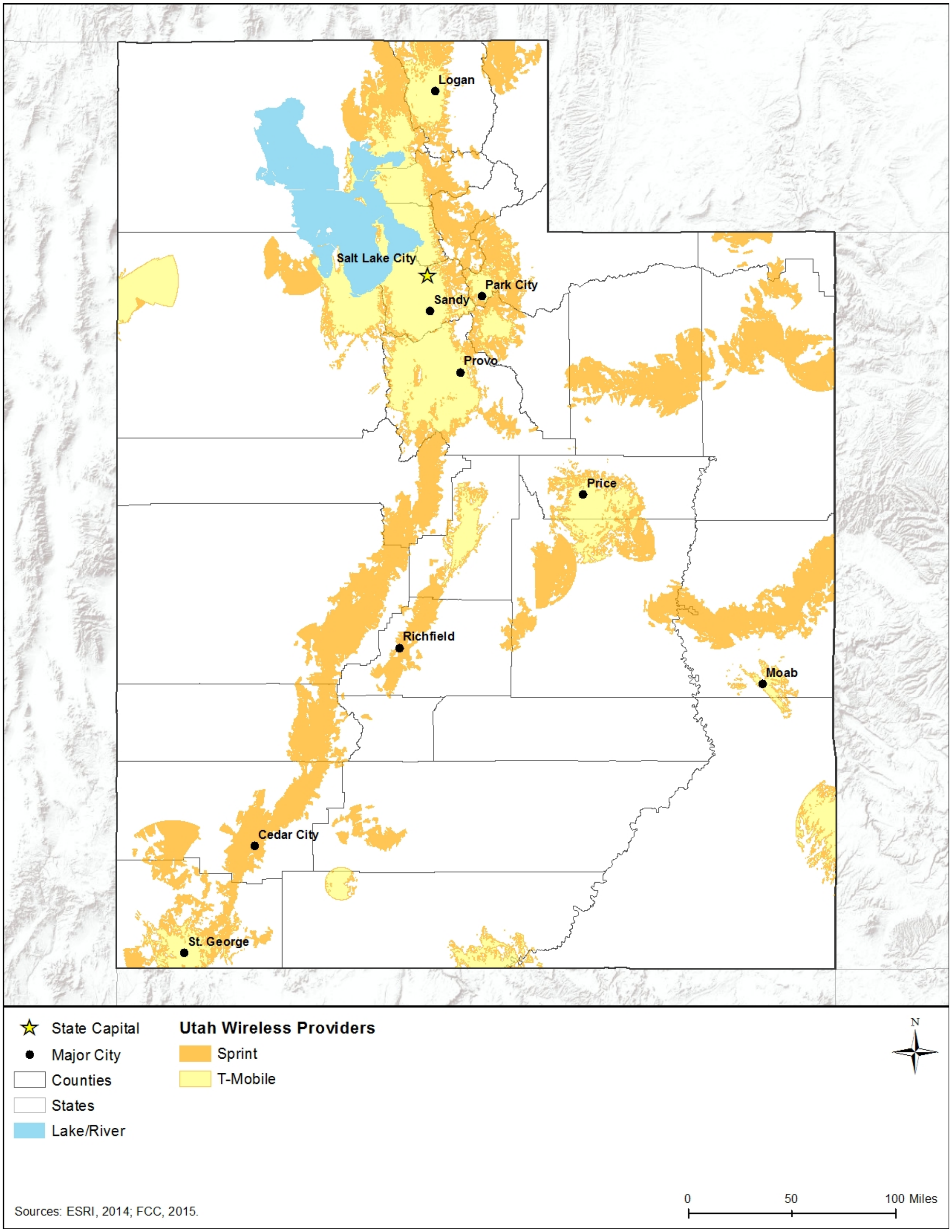


Figure 16.1.1-7: Sprint and T-Mobile Wireless Availability in Utah

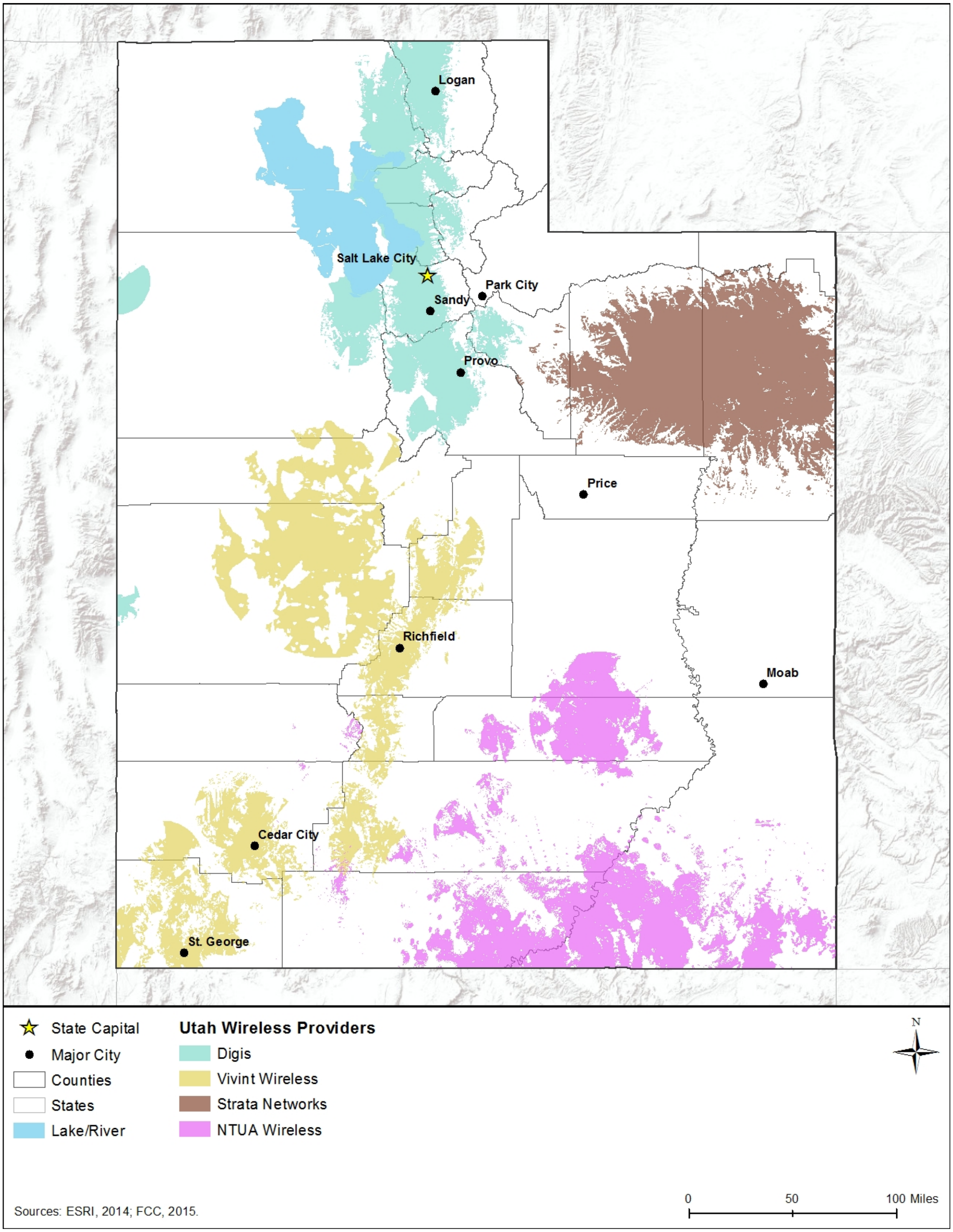


Figure 16.1.1-8: NTUA Wireless, Vivint Wireless, Strata Networks, and Digis Wireless Availability in Utah

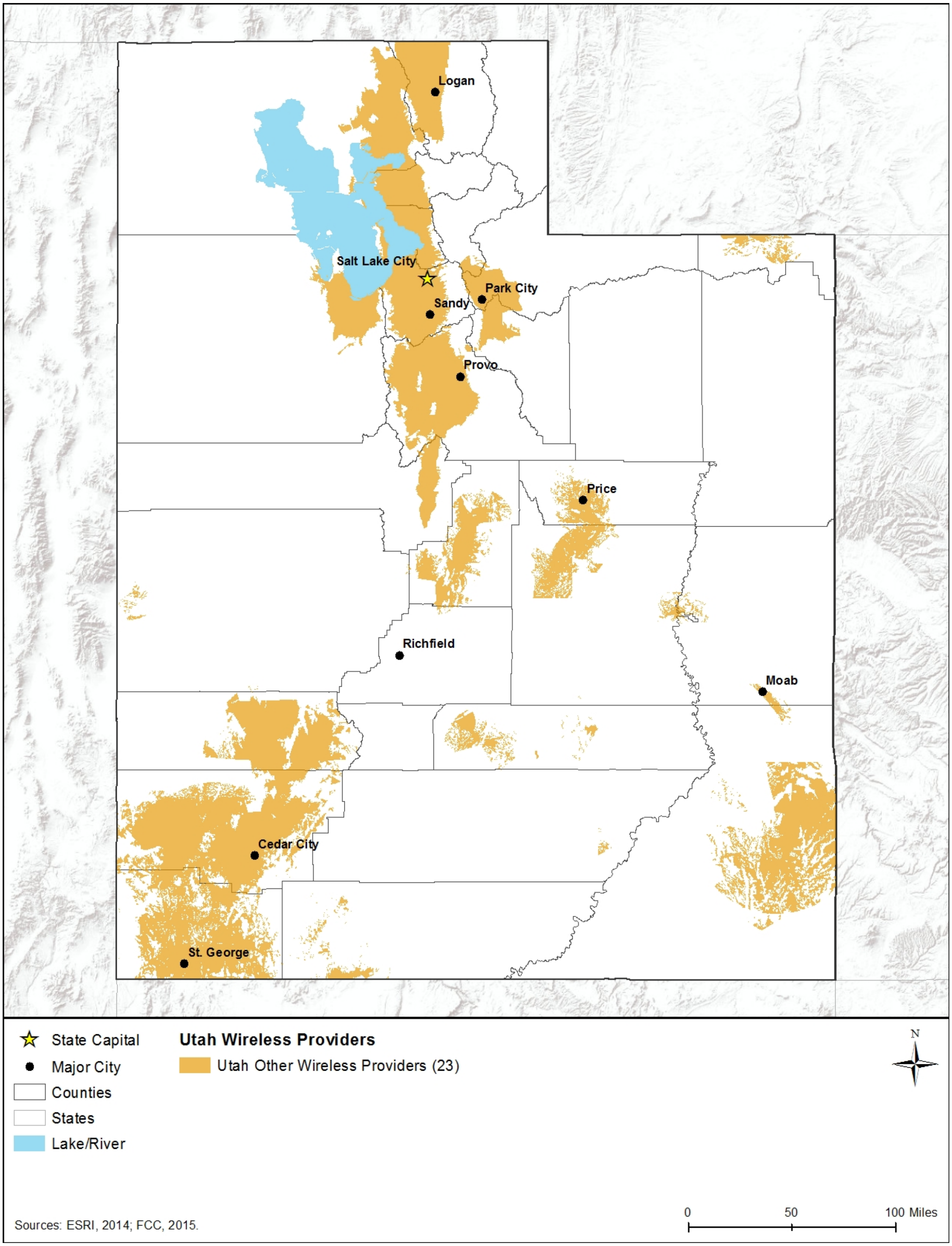


Figure 16.1.1-9: Other Providers Wireless Availability in Utah

Towers

There are many types of domestic towers employed today by the telecommunications industry, government agencies, and other owners. Towers are designed and used for a variety of purposes, and the height, location, and supporting structures and equipment are all designed, constructed, and operated according to the technical specifications of the spectrum used, the type of equipment mounted on the tower, geographic terrain, need for line-of-sight transmissions to other towers, radio frequency needs, and other technical specifications. There are three general categories of stand-alone towers: monopole, lattice, and guyed. Typically, monopole towers are the smallest, followed by lattice towers at a moderate height, and guyed towers at taller heights (with the guyed wires providing tension support for the taller heights) (CSC, 2007). In general, taller towers can provide communications coverage over larger geographic areas, but require more land for the actual tower site, whereas shorter towers provide less geographic coverage and require less land for the tower site (USFS, 2009a). Figure 16.1.1-10 presents representative examples of each of these categories or types of towers.

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

Lattice
200 – 400 feet
Source: Personal Picture

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

Figure 16.1.1-10: Types of Towers

Telecommunications tower infrastructure proliferates throughout Utah, although tower infrastructure is concentrated in the higher and more densely populated areas of Utah. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC (FCC, 2016a).[11] Table 16.1.1-9 presents the number of towers (including broadcast towers) registered with the FCC in Utah, by tower type, and Figure 16.1.1-11 presents the location of those structures, as of June 2016.

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

Table 16.1.1-9: Number of Commercial Towers in Utah by Type

Constructed[a] Towers[b]		Constructed Monopole Towers	
100ft and over	15	100ft and over	0
75ft – 100ft	50	75ft – 100ft	0
50ft – 75ft	67	50ft – 75ft	0
25ft – 50ft	195	25ft – 50ft	27
25ft and below	141	25ft and below	21
Subtotal	**468**	**Subtotal**	**48**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	0	100ft and over	0
75ft – 100ft	0	75ft – 100ft	0
50ft – 75ft	0	50ft – 75ft	0
25ft – 50ft	3	25ft – 50ft	3
25ft and below	1	25ft and below	3
Subtotal	**4**	**Subtotal**	**6**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	0	100ft and over	0
75ft – 100ft	13	75ft – 100ft	0
50ft – 75ft	15	50ft – 75ft	0
25ft – 50ft	17	25ft – 50ft	0
25ft and below	8	25ft and below	0
Subtotal	**53**	**Subtotal**	**0**
Constructed Tanks[d]			
Tanks	0		
Subtotal	**0**		
Total All Tower Structures		**579**	

Source: (FCC, 2015c)

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

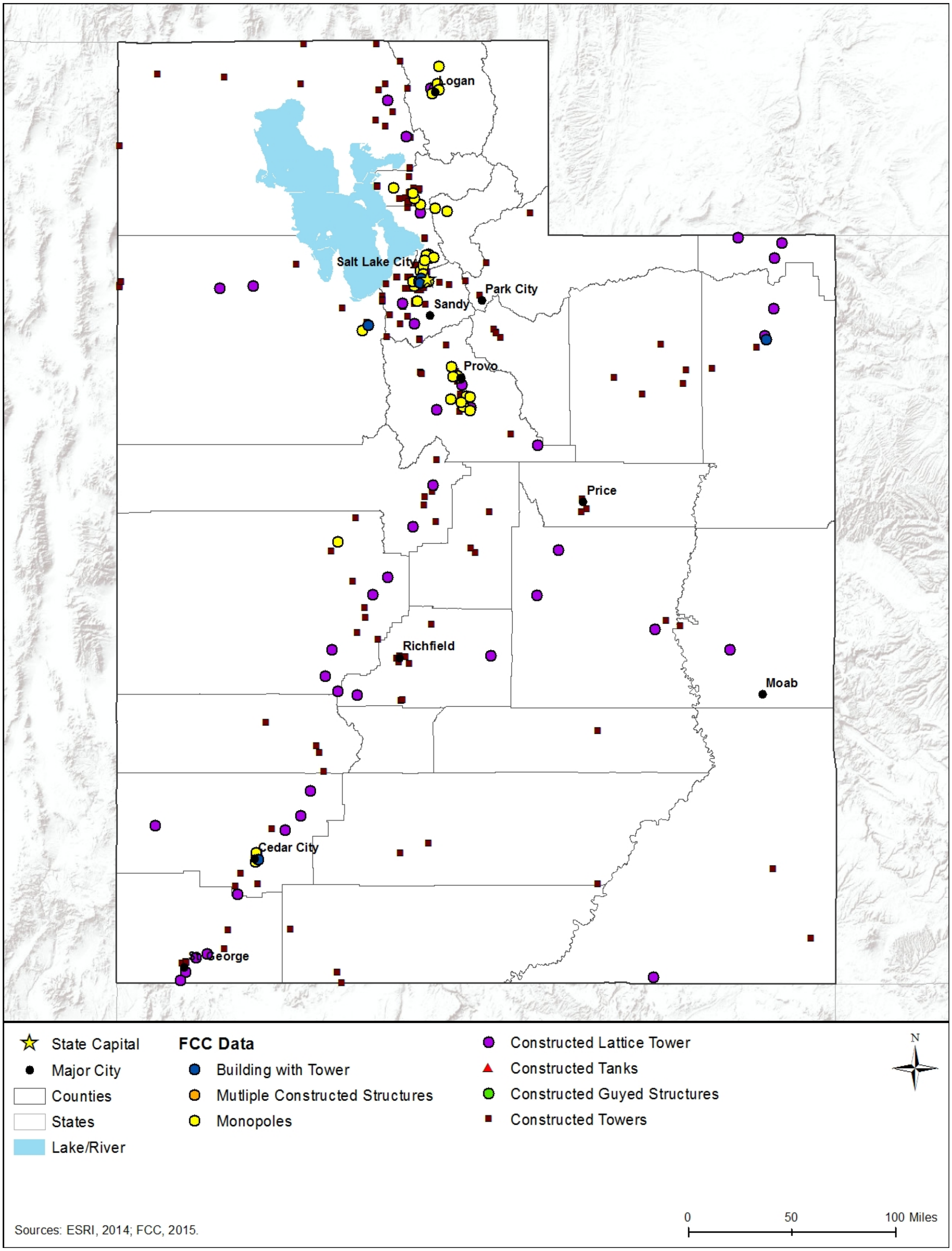
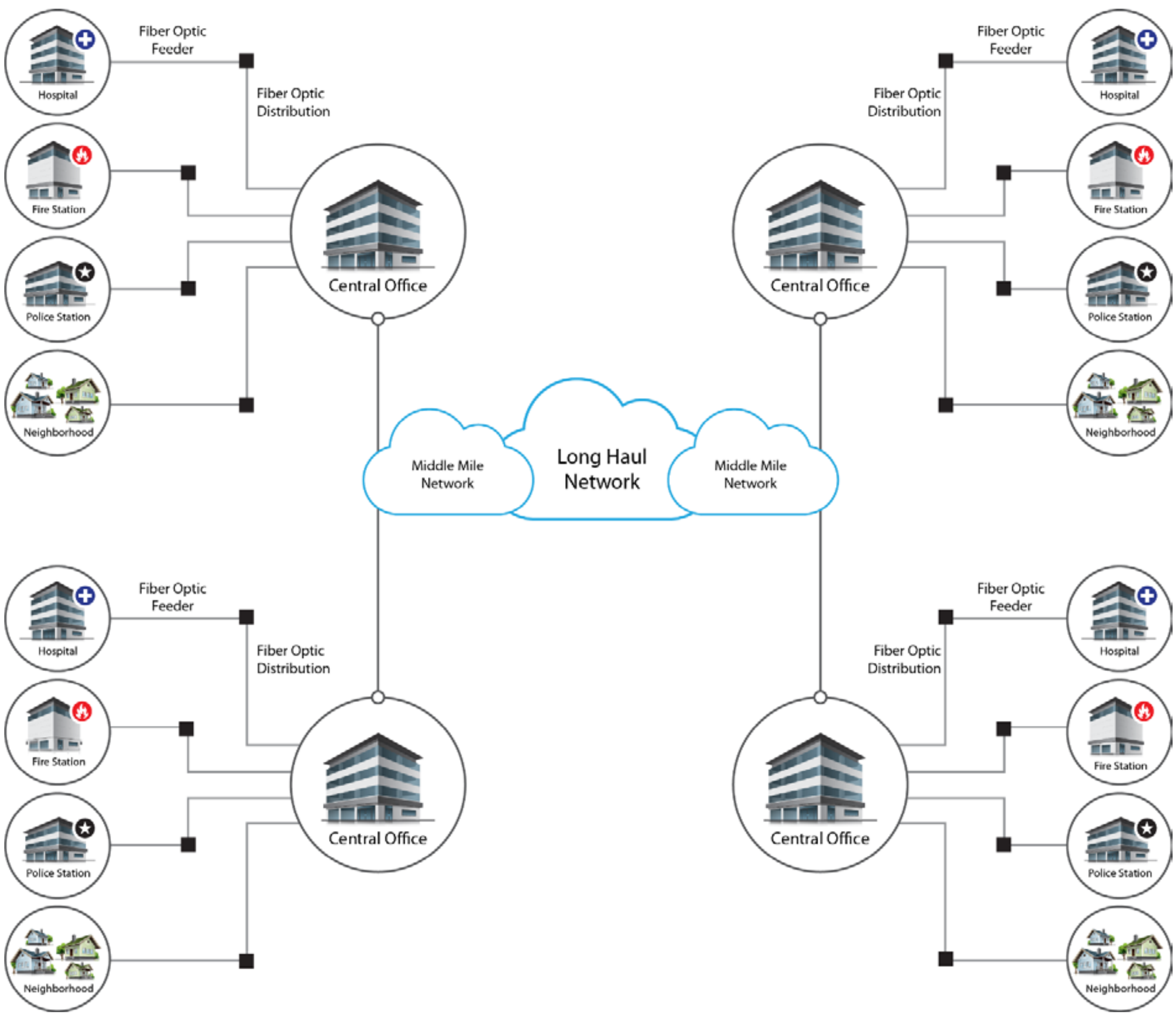


Figure 16.1.1-11: FCC Tower Structure Locations in Utah

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 16.1.1-12. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).



Prepared by: Booz Allen Hamilton

Figure 16.1.1-12: Typical Fiber Optic Network in Utah

Last Mile Fiber Assets

In Utah, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Utah there are 33 fiber providers that offer service in the state, as listed in Table 16.1.1-10. Figure 16.1.1-13 shows coverage for CenturyLink and Frontier Communications of Utah, Figure 16.1.1-14 shows coverage for Comcast, CentraCom, and South Central Utah Telephone Association, Inc., and Figure 16.1.1-15 shows coverage for all other providers with a less than 5 percent coverage area, respectively.

Table 16.1.1-10: Fiber Provider Coverage

Fiber Provider	Coverage
CenturyLink	1.59%
Frontier Communications of Utah	1.00%
Comcast	0.97%
CentraCom	0.87%
South Central Utah Telephone Association, Inc.	0.81%
Other[a]	3.14%

Source: (NTIA, 2014)

[a] Other: Provider with less than 5% coverage area. Providers include: MegaPath Corporation; Strata Networks; Integra Telecom; Syringa Networks LLC; All West Communications, Inc.; Beehive Broadband; Emery Telecommunication & Video, Inc.; TDS TELECOM; UTOPIA; Union Wireless; InfoWest, Inc.; Interlinx Communications; Navajo Communications Company, Inc.; Gtelco; Manti Telephone; Level 3 Communications, LLC; XO Communications Services, Inc.; BRESNAN COMMUNICATIONS; Direct Communications Cedar Valley; Google Fiber; SenaWave; Veracity Networks; Skywire Fiber; Spanish Fork Community Network; Albion Telephone Company, Inc.; AF Connect; Cogent Communications; Farmers Telephone Company Inc.

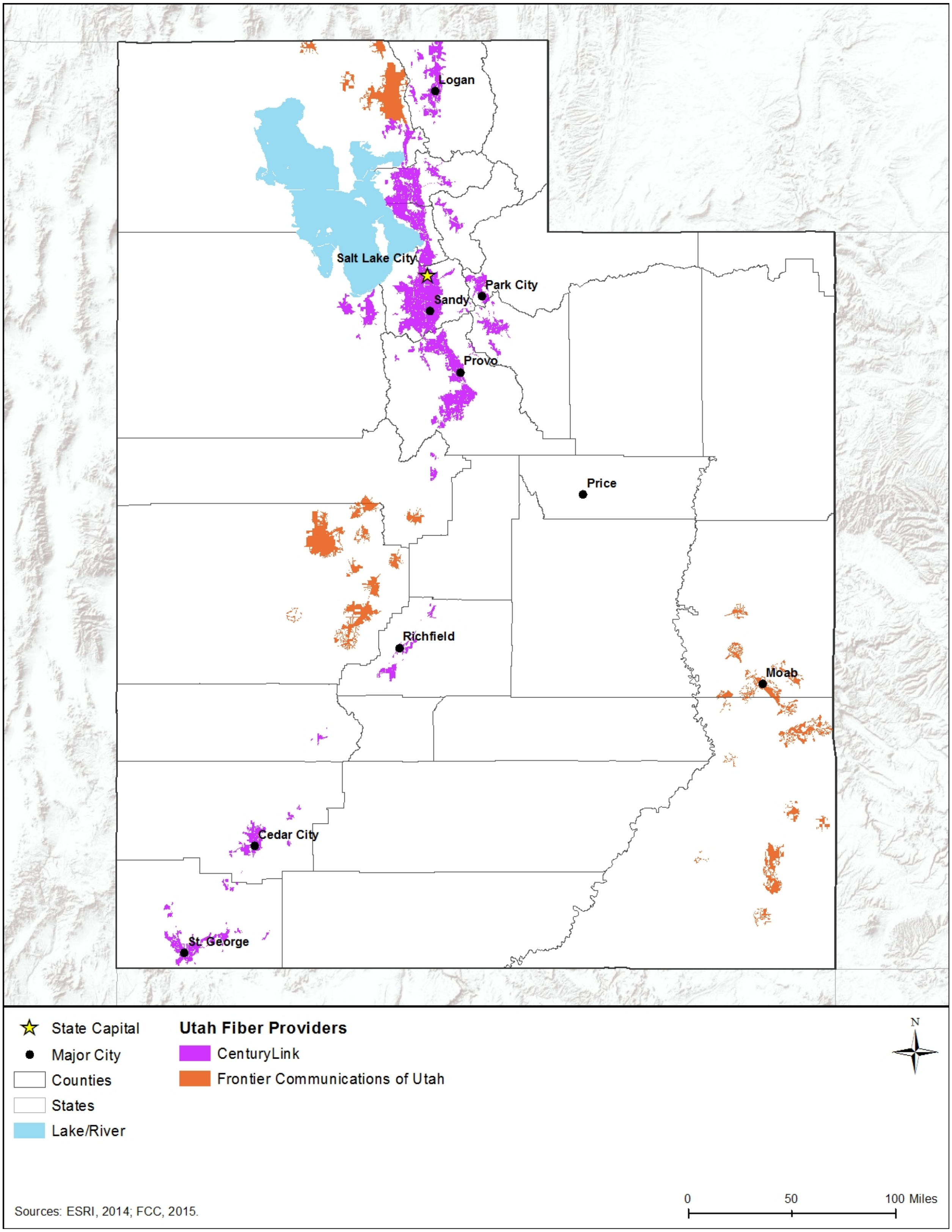


Figure 16.1.1-13: Fiber Availability in Utah for CenturyLink and Frontier Communications

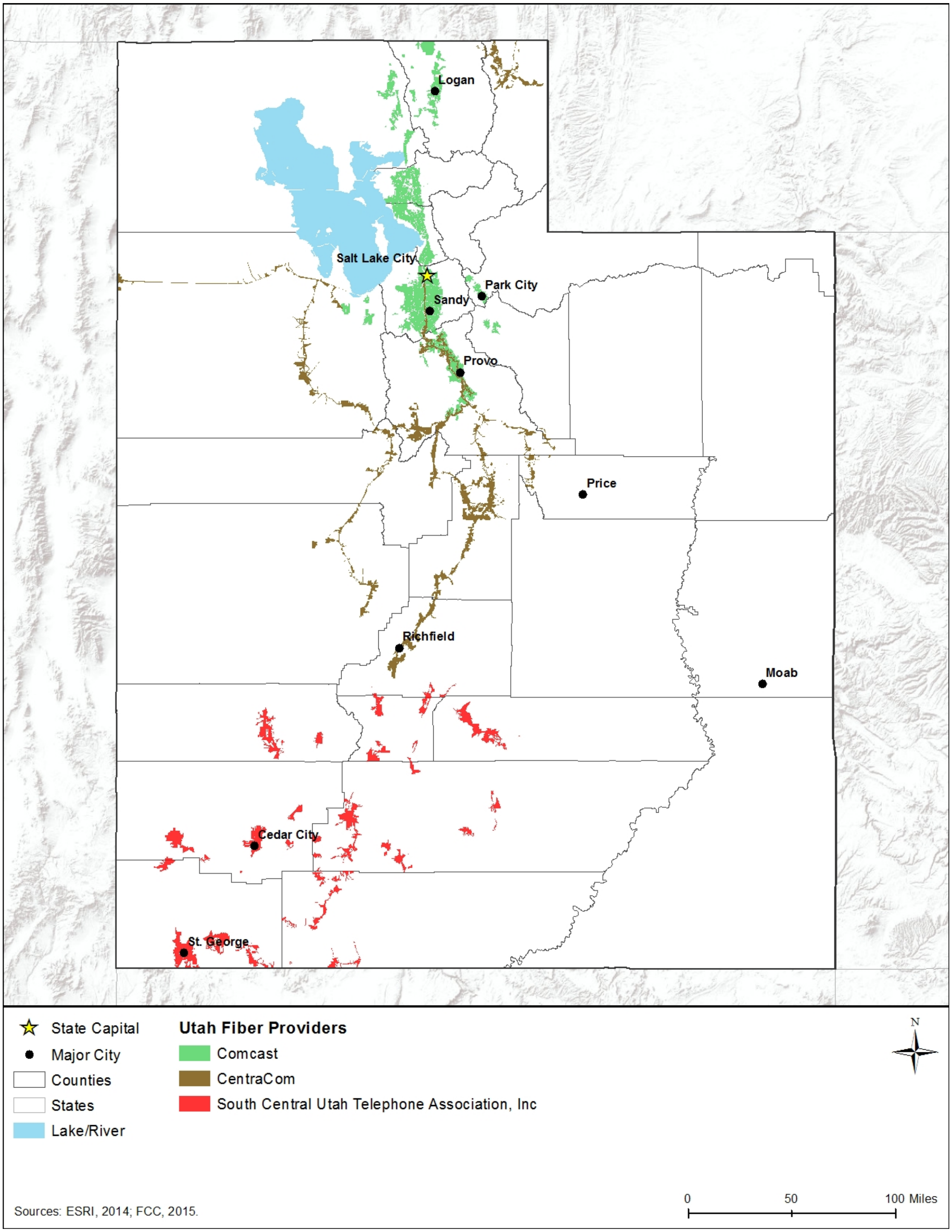


Figure 16.1.1-14: Comcast's, CentraCom, and South Central Utah Telephone Association Inc.'s Fiber Availability in Utah

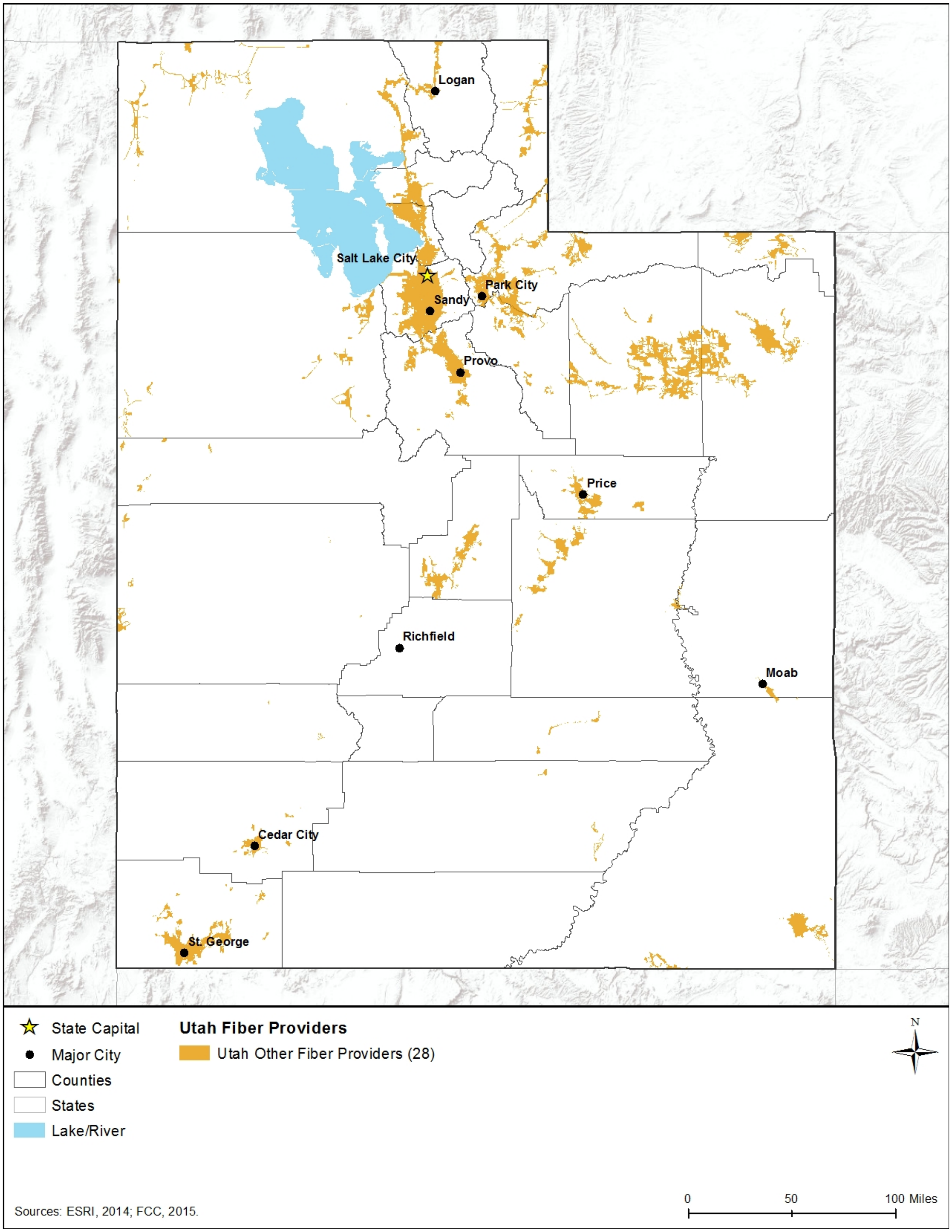


Figure 16.1.1-15: Other Provider's Fiber Availability in Utah

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.

16.1.1.6. 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 16.1.4, Water Resources, describes the potable water sources in the state.

Electricity

The Utah Public Service Commission (PSC) regulates electricity utilities that are owned by investors or a cooperative (DPU, 2015a). The PSC is tasked with the regulation of utility rates and the quality of their service, but has no jurisdiction over municipal (government owned) utilities (PSC, 2015a). As of 2013, there were two investor owned utilities, nine retail cooperatives, one wholesale cooperative, and three utilities classified as "other electric utilities" that fell under the PSC's jurisdiction (DPU, 2013). An additional eleven Rural Electric Cooperatives (RECs) also have their rates and services overseen by the PSC (DPU, 2015b). Utah is also home to 44 municipal electric systems, of which most belong to groups like the Utah Associated Municipal Power Systems (UAMPS) or the Utah Municipal Power Agency (UMPA) (DPU, 2015c). UAMPS "is a political subdivision of the State of Utah that provides comprehensive wholesale electric-energy, on a nonprofit basis, to community-owned power systems throughout the Intermountain West," they serve customers in eight states (UAMPS, 2015). UMPA provides similar services to its member municipalities: Levan, Manti, Nephi, Provo, Salem and Spanish Fork (UMPA, 2015).

The bulk of the electricity generated in Utah comes from coal-fueled power plants (EIA, 2015a). In 2014, coal plants generated 76 percent of the state's electricity, or 33,376,688 megawatt-hours of the total 43,784,526 megawatts.[12] Of the remainder of Utah's electricity generation, 19 percent was generated by natural gas facilities, with hydroelectric power and other renewable sources accounting for the rest. Since at least 2001, coal-fueled electric plants have accounted for the largest portion of the state's generation. In 2014, wind power accounted for 1.5 percent of total power generation, while geothermal power contributed to about 1.2 percent of the state's total power generation (EIA, 2015a). The state has set a "voluntary goal of using cost-effective

[12] One megawatthour is defined as one thousand kilowatt-hours or 1 million watt-hours; where one watthour is "the electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour" (EIA, 2015d).

eligible renewable energy resources to provide 20 percent of their 2025 adjusted retail electric sales" (EIA, 2014). When it comes to electricity, the transportation and industrial sectors use the largest amounts, at 30.1 percent and 29.1 percent respectively. Residential customers use 21.1 percent while the commercial sector uses just 19.7 percent (EIA, 2014).

Water

The Utah PSC regulates water utilities that are owned by investors or a cooperative and is tasked with the regulation of utility rates and the quality of their service (DPU, 2015a). However, it has no jurisdiction over municipal (government owned) utilities (PSC, 2015a). There are 29 water utilities whose actions are regulated by the PSC (DPU, 2015d).

The regulation of drinking water standards falls under the jurisdiction of the Utah Department of Environmental Quality (UDEQ) (UDEQ, 2015a). The Department's Division of Drinking Water operates a Source Protection Program that requires "that each public drinking water supplier prepare a source protection plan" (UDEQ, 2015b). The Safe Drinking Water Act requires utilities to prepare consumer confidence reports, which are annual reports on water quality for their customers. These reports detail any contaminants in treated water, likely sources of contamination, and the findings of source water assessments from the Source Protection Program (UDEQ, 2015c). In the furtherance of its goals, the UDEQ also operates programs for the certification of water system operators (UDEQ, 2015d).

Wastewater

The Utah PSC regulates wastewater utilities that are owned by investors or a cooperative (DPU, 2015a). The PSC is tasked with the regulation of utility rates and the quality of their service, but has no jurisdiction over municipal (government owned) utilities (PSC, 2015a). Currently there are only two wastewater companies subject to the jurisdiction of the Commission: Mountain Sewer Corporation and Storm Haven Water Company Inc. (DPU, 2015d). Since 1991, the state has mandated that all wastewater facility operators be certified by the UDEQ (DPU, 2015e). Facilities wishing to discharge treated wastewater in Utah must obtain a Utah Pollutant Discharge Elimination System (UPDES) permit which is issued by the Utah Division of Water Quality. There are 142 active UPDES individual permits in the state (UDEQ, 2015f).

Solid Waste

The management of solid waste in Utah is overseen by the UDEQ through its Solid Waste Program. The Solid Waste Program offers permitting services and ensures compliance with state and federal waste management regulations (UDEQ, 2015g). In 2014, there were 3,598,574 tons of waste disposed of in 116 state facilities; of this, 2,121,447 tons (59 percent) was municipal waste. The remainder came from industrial or construction sources, with 37,739 (1 percent) being recycled (UDEQ, 2016a). As of 2013, there were 96 landfills operating in the state, though some were owned by out-of-state sources (UDEQ, 2015h). Additionally, the 22 composting facilities in Utah received 35,746 tons of material (UDEQ, 2015i).

16.1.2. Soils

16.1.2.1. 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, 2015b)

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, 2015b)

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.

16.1.2.2. 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 16.1.2-1 below.

Table 16.1.2-1: Relevant Utah Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Utah Water Quality Act , Title 19, Chapter 5, Utah Code Annotated 2004[a]	UDEQ	Erosion and sediment control practices are required at construction sites one acre in size or larger, required as part of the Utah Construction Storm Water General Permit.

[a] (UDEQ, 2014a)

16.1.2.3. Environmental Setting

Utah is composed of three Land Resource Region (LRR),[13] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006):

- Northwestern Wheat and Range Region
- Rocky Mountain Range and Forest Region
- Western Range and Irrigated Region

Within and among Utah's three LRRs are 12 Major Land Resource Areas (MLRA),[14] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (NRCS, 2006). The locations and characteristics of Utah's MLRAs are presented in Figure 16.1.2-1 and Table 16.1.2-2, 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[15] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[16] 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[17] (discussed further in the subsections below).

[13] Land Resource Region: A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics (NRCS, 2006).
[14] 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).
[15] The flora and fauna of a region.
[16] 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, D.; Olshansky, R.; Rogers, B. R., 2004)
[17] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009a).

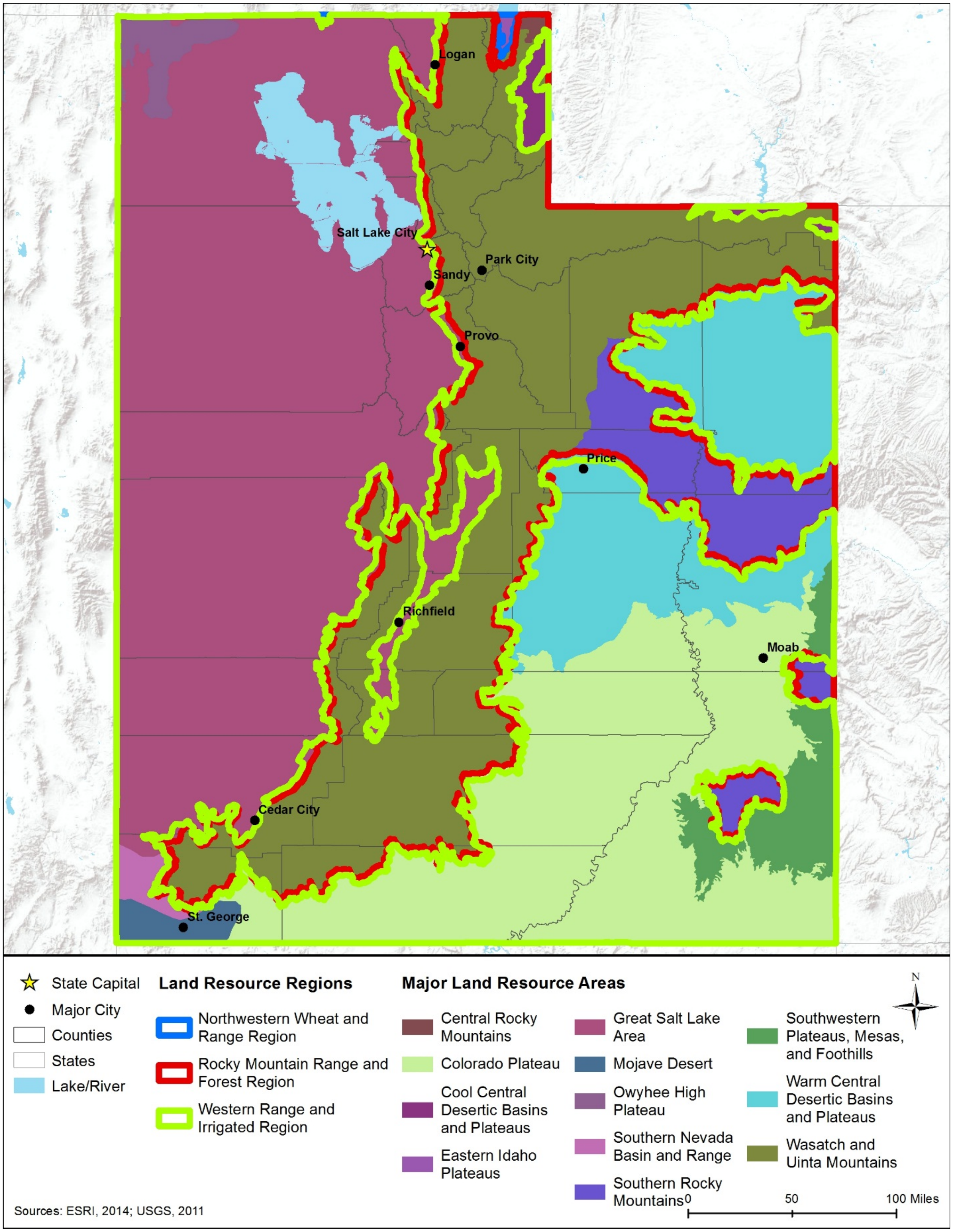


Figure 16.1.2-1: Locations of Major Land Resource Areas in Utah

Table 16.1.2-2: Characteristics of Major Land Resource Areas in Utah

MLRA Name	Region of State	Soil Characteristics
Central Rocky Mountains	Northern Utah	Alfisols,[a] Inceptisols,[b] and Mollisols,[c] are the dominant soil orders. These soils are medium to coarse textured, and are typically skeletal[18].
Colorado Plateau	Southeastern Utah	Alfisols, Aridisols,[d] Entisols,[e] and Mollisols are the dominant soil orders. These clayey or loamy[f] soils are well drained or somewhat excessively drained. They range from very deep to very shallow.
Cool Central Desertic Basins and Plateaus	Northern Utah	Aridisols and Entisols are the dominant soil orders. These typically well drained soils extend down to shale or sandstone bedrock, and can range from somewhat deep to shallow.
Eastern Idaho Plateaus	Northern Utah	Mollisols is the dominant order. These loamy and well drained soils are typically very deep or deep.
Great Salt Lake Area	Western Utah	Aridisols, Entisols, and Mollisols are the dominant soil orders. These very deep soils are well drained to somewhat excessively drained, and are loamy or loamy skeletal.
Mojave Desert	Southwestern Utah	Aridisols and Entisols are the dominant soil orders. These soils range from shallow to very deep, and are well drained or excessively drained. They are loamy-skeletal or sandy-skeletal.
Owyhee High Plateau	Northwestern Utah	Aridisols and Mollisols are the dominant soil orders. These well drained soils range from shallow to moderately deep, and are loamy or clayey.
Southern Nevada Basin and Range	Southwestern Utah	Aridisols and Entisols are the dominant soil orders, and Mollisols also figure prominently in mountainous areas. These soils are loamy-skeletal or sandy-skeletal, and are well drained or somewhat excessively drained. They range from very shallow to very deep.
Southern Rocky Mountains	Eastern Utah	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders.
Southwestern Plateaus, Mesas, and Foothills	Southeastern Utah	Alfisols, Aridisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These soils range from shallow to very deep and are loamy, clayey, or silty.
Warm Central Desertic Basins and Plateaus	Eastern Utah	Aridisols and Entisols are the dominant soil orders, with Mollisols present at higher elevations. These typically well drained soils extend down to shale or sandstone bedrock, and can range from somewhat deep to shallow.
Wasatch and Uinta Mountains	Central Utah	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)
[a] 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% of the world's ice-free land surface" (Natural Resources Conservation Service, 2015d).
[b] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates, and make up nearly 17% of the world's ice-free land surface" (Natural Resources Conservation Service, 2015d).

[18] Soils that contain 35 percent or more (by volume) of rock fragments, cobbles, gravel, and laterite concretions or ironstones having diameters greater than 2 mm, within shallow depths (less than 50 cm).

[c] Mollisols: "Soils that have a dark colored surface horizon relatively high in content of organic matter. They are base rich throughout and quite fertile. Mollisols form under grass in climates that have a moderate to pronounced seasonal moisture deficit" (Natural Resources Conservation Service, 2015d).
[d] 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% of the world's ice-free land surface" (Natural Resources Conservation Service, 2015d).
[e] Entisols: "Soils that show little to no pedogenic horizon development. They occur in areas of recently deposited parent materials or in dunes, steep slopes, or flood plains where erosion or deposition rates are faster than rate of soil development. They make up nearly 16% of the world's ice-free land surface." (Natural Resources Conservation Service, 2015d)
[f] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts" (Purdue University Consumer Horticulture, 2006).

16.1.2.4. Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy;[19] there are 12 soil orders in the world and they are characterized by both observed and inferred[20] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (NRCS, 2015e). The STATSGO2[21] soil database identifies 27 different soil suborders in Utah (NRCS, 2015a). Figure 16.1.2-2 depicts the distribution of the soil suborders, and Table 16.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

It should also be noted that Utah contains the unique Peteetneet Soils Series[22] or peat soil. Located in Utah County, the series consist of "deep, very poorly drained, moderately permeable soils that formed in organic materials" (NRCS, 2008). The Peteetneet soils are found in low lake terraces on nearly level to gently sloping depressions (NRCS, 2008).

[19] Science of naming and classifying organisms or specimens.
[20] "Soil properties inferred from the combined data of soil science and other disciplines (e.g., soil temperature and moisture regimes inferred from soil science and meteorology)" (NRCS, 2015i).
[21] STATSGO2 is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map is comprised of general soil association units and is maintained and distributed as a spatial and tabular dataset.
[22] The Peteetneet Soil Series is in the Saprists suborder (USDA, 2004).

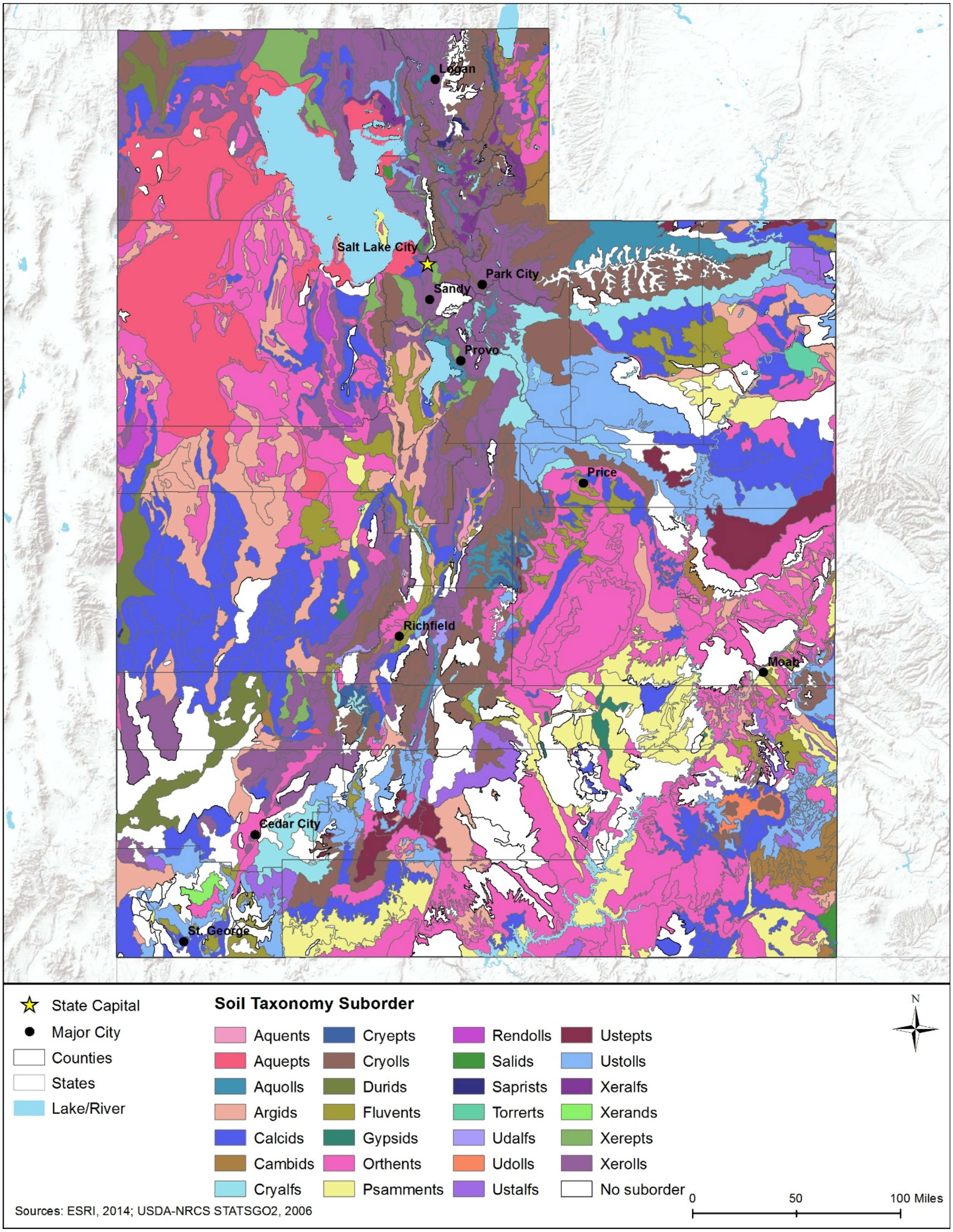


Figure 16.1.2-2: Utah Soil Taxonomy Suborder

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Table 16.1.2-3: Major Characteristics of Soil Suborders[23] Found in Utah, as depicted in Figure 16.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[a]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
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.	Silty clay, Silty clay loam	0-2	Poorly drained	No, Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage. If these soils have not been artificially drained, groundwater is at or near 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.	Clay loam, Silt loam, Silty clay loam	0-3	Somewhat poorly drained to poorly drained	No, Yes	C	Medium	Low	Medium	High, due to hydric soil and poor drainage conditions
Mollisols	Aquolls	Aquolls support grass, sedge, and forb vegetation, as well as some forest vegetation. However, most have been artificially drained and utilized as cropland.	Clay loam, Gravelly loam Loam, Silt loam, Silty clay loam, Stratified fine sandy loam to silty clay, Very fine sandy loam	0-5	Very poorly drained to well drained	No, Yes	B, C, D	Medium, High	Moderate, Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
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, Extremely cobbly sandy loam, Fine sandy loam, Gravelly clay loam, Gravelly loam, Loam, Sand, Sandy clay loam, Sandy loam, Silt loam, Silty clay, Silty clay loam, Stony sandy clay, Stratified very gravelly fine sandy loam to gravelly loam, Unweathered bedrock, Very cobbly loam, Very cobbly sandy clay loam, Very fine sandy loam, Very gravelly sand	0-60	Well drained to excessively drained	No	B, C, D	Medium, High	Moderate, Low	Medium to High, depending on slope	Low

[23] 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.

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[a]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
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.	Clay loam, Cobbly loam, Extremely cobbly loam, Fine sandy loam, Flaggy loam, Gravelly fine sandy loam, Gravelly loam, Gravelly sandy clay loam, Gravelly silt loam, Loam, Loamy fine sand, Sandy loam, Silt loam, Silty clay, Unweathered bedrock, Very channery loam, Very channery sandy loam, Very cobbly loam, Very cobbly loamy sand, Very cobbly silt loam, Very fine sandy loam, Very gravelly loam, Very gravelly loamy coarse sand, Very gravelly sandy loam, Very gravelly silt loam, Very stony fine sandy loam, Very stony loam, Weathered bedrock	0-70	Poorly drained to well drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Aridisols	Cambids	Cambids are found in the western United States, with little soil development. They are primarily used as wildlife habitat or rangeland, although some can also be used as cropland, if irrigated.	Clay loam, Cobbly fine sandy loam, Fine sandy loam, Silt loam, Very fine sandy loam, Weathered bedrock	0-20	Moderately well drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
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.	Cobbly sandy loam, Extremely gravelly loam, Gravelly clay loam, Gravelly sandy clay loam, Gravelly sandy loam, Loam, Stony sandy loam, Very cobbly clay loam, Very gravelly loam, Very gravelly sandy loam	3-70	Well drained	No	B, C	Medium	Moderate, Low	Medium	Low
Inceptisols	Cryepts	Cryepts are soils of high latitudes or high elevations, and support cold weather vegetation such as conifers and hardwoods. They are mostly used as forest or wildlife habitat, although some are also used as cropland.	Extremely stony sandy, loam, Gravelly loam, Sandy loam, Silty clay, Very gravelly sandy loam	5-70	Well drained to somewhat excessively drained	No	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[a]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
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.	Clay loam, Cobbly loam, Cobbly sandy clay loam, Gravelly clay loam, Gravelly loam, Gravelly silt loam, Loam, Sandy clay loam, Silt loam, Silty clay loam, Unweathered bedrock, Very channery loam, Very cobbly clay, Very cobbly clay loam, Very cobbly loam, Very cobbly sandy clay loam, Very cobbly sandy loam, Very cobbly silty clay loam, Very gravelly clay loam, Very gravelly loam, Very gravelly sand, Very gravelly sandy loam	0-70	Somewhat poorly drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Aridisols	Durids	Durids are found in the western United States, with the majority found in Nevada and Idaho. A few areas are used as irrigated cropland, but most are utilized as wildlife habitat or rangeland. They are characterized by a soil subsurface horizon cemented by silica (duripan).	Gravelly loam, Loam	2-70	Well drained	No	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	Low
Entisols	Fluvents	Fluvents are mostly freely drained soils that form in recently-deposited sediments on flood plains, fans, and deltas 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.	Cobbly fine sandy loam, Fine sandy loam, Loam Silt loam, Silty clay, Silty clay loam, Stratified fine sandy loam to loam, Stratified gravelly loamy sand to fine sandy loam, Variable, Very cobbly coarse sand, Very cobbly loamy sand, Very fine sandy loam	0-10	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
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, Silt loam	0-15	Somewhat poorly drained to well drained	No	B, C	Medium	Moderate, Low	Medium	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[a]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Channery loam, Channery sandy loam, Clay, Clay loam, Extremely gravelly loam, Fine sandy loam, Gravelly fine sandy loam, Gravelly loam, Gravelly loamy sand, Gravelly sandy clay loam, Loam, Loamy fine sand, Loamy sand, Loamy very fine sand, Sandy loam, Silt loam, Silty clay, Silty clay loam, Stratified loamy sand to loam, Stratified very gravelly coarse sand to extremely gravelly sandy loam, Unweathered bedrock, Very channery sandy loam, Very cobbly sandy loam, Very fine sandy loam, Very gravelly clay loam, Very gravelly loam, Very gravelly loamy sand, Very gravelly very fine sandy loam, Weathered bedrock	0-90	Moderately well drained to excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Entisols	Psamments	Psamments are sandy in all layers. In some arid and semi-arid climates, they are among the most productive rangeland soils, and are primarily used as rangeland, pasture, or wildlife habitat. Those Psamments that are nearly bare are subject to wind erosion and drifting, and do provide good support for wheeled vehicles.	Fine sand, Loamy fine sand, Loamy sand, Sand	0-30	Well drained to excessively drained	No	A, D	Low, High	High, Very Low	Low to High, depending on slope	Low
Mollisols	Rendolls	Rendolls are found in more humid areas. They are formed under grass and shrubs or forest vegetation in highly calcareous parent materials. Most of these soils are used for pasture or cropland, although some are used for forest or rangeland.	Very gravelly loam	15-50	Well drained	No	D	High	Very Low	High	Low
Aridisols	Salids	Salids are primarily found in Nevada and Utah, and commonly in depressions (playas). They have a saline horizon that makes them unsuitable for agricultural use unless they are leached of salts. Therefore, most of these soils are utilized for wildlife habitat or rangeland.	Clay loam, Silty clay, Silty clay loam	0-12	Very poorly drained to well drained	No, Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Histosols	Saprists	Saprists have organic materials are well decomposed, and many support natural vegetation and are used as woodland, rangeland, or wildlife habitat. Some Saprists, particularly those with a mesic or warmer temperature regime, have been cleared, drained, and used as cropland.	Stratified muck to silt loam	0-2	Very poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Vertisols	Torrerts	Torrerts are soils that consist of primarily grasses and forbs and are used as rangeland. Their slow permeability means that irrigation can cause waterlogging and accumulation of salinity without other means of drainage.	Silty clay loam	4-25	Well drained	No	D	High	Very Low	High	Low
Alfisols	Udalfs	Udalfs have a udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Very cobbly clay loam, Very gravelly loam	8-25	Well drained	No	D	High	Very Low	High	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[a]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
Mollisols	Udolls	Udolls are found in humid climates. They are more or less freely drained, and have historically supported tall grass prairie. They are used as pasture or rangeland, and as cropland in areas with little slope.	Loam	1-5	Moderately well drained	No	B	Medium	Moderate	Medium	Low
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, Fine sandy loam, Loam, Unweathered bedrock, Very cobbly loam, Very fine sandy loam	0-70	Moderately well drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Inceptisols	Ustepts	Ustepts are freely drained soils, typically used as pasture or cropland, although some support forest, rangeland, and wildlife habitat.	Loam, Stratified loamy sand to gravelly loam, Unweathered bedrock, Very cobbly loam	1-80	Well drained to somewhat excessively drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
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, Clay loam, Cobbly clay loam, Cobbly loam, Extremely channery loam, Extremely cobbly clay loam, Extremely cobbly loam, Fine sandy loam, Gravelly clay loam, Gravelly fine sandy loam, Gravelly sandy clay loam, Loam, Loamy fine sand, Sand, Sandy clay loam, Silt loam, Silty clay, Silty clay loam, Unweathered bedrock, Very channery loam, Very cobbly loam, Very cobbly sandy clay loam, Very fine sandy loam, Very gravelly clay loam, Very gravelly loam, Very gravelly sand	0-80	Somewhat poorly drained to somewhat excessively drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Alfisols	Xeralfs	Xeralfs support warmer weather, drier vegetation such as annual grasses, forbs, and woody shrubs, along with cooler, wetter vegetation such as coniferous forest. They are typically used for forest, grazing, and croplands.	Gravelly clay loam, Sandy clay loam, Silty clay, Very gravelly clay loam	0-60	Somewhat poorly drained to well drained	No	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	Low
Andisols	Xerands	Xerands are used as forest, pasture, or cropland. They form under grass and shrub vegetation or under coniferous forest vegetation.	Unweathered rock	30-70	Well drained	No	B	Medium	Moderate	Medium	Low
Inceptisols	Xerepts	Xerepts support coniferous forest, shrubs, grasses, and trees, are typically used for forest, pasture, or croplands, and sometimes as wildlife habitat or rangeland. They are generally freely drained and found in the western United States.	Fine sandy loam, Silt loam, Silty clay loam, Stratified extremely gravelly sandy loam to very gravelly loam	0-30	Well drained to somewhat excessively drained	No	B	Medium	Moderate	Medium	Low

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[a]	Hydrologic Group	Runoff Potential	Permeability[b]	Erosion Potential	Compaction and Rutting Potential
Mollisols	Xerolls	Xerolls are found on sloping lands that Mediterranean climates. They are generally freely drained, although typically dry for extended periods in summer. These soils are used for irrigated croplands, and those on very steep slopes are used for rangeland and forest.	Clay loam, Cobbly loam, Cobbly sandy clay loam, Cobbly sandy loam, Cobbly silt loam, Extremely cobbly clay, Extremely gravelly loam, Fine sandy loam, Gravelly clay loam, Gravelly loam, Gravelly sandy loam, Indurated, Loam, Loamy fine sand, Loamy sand, Sandy clay loam, Sandy loam, Silt loam, Silty clay loam, Unweathered bedrock, Very cobbly clay, Very cobbly clay loam, Very cobbly loam, Very cobbly sandy clay loam, Very cobbly sandy loam, Very cobbly silt loam, Very fine sandy loam, Very gravelly clay loam, Very gravelly loam, Very gravelly sand, Very gravelly sandy clay loam, Very gravelly sandy loam, Very stony loam, Very stony sandy clay loam	0-70	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

Source: (NRCS, 2015a) (Natural Resources Conservation Service, 1999)
[a] Hydric Soil: "A soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (NRCS, 2015c). Soil suborders constitute a broad range of soil types. Within each soil suborder, some specific soil types are hydric while others are not.
[b] Based on Runoff Potential, described in 16.1.2.5.

16.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[24] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 16.1.2-3 (above) provides a summary of the runoff potential for each soil suborder in Utah.

Group A. Sand, loamy sand or sandy loam soils. This group of soils has "low runoff potential and high infiltration rates[25] 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). Calcids, Fluvents, Orthents, Psamments, and Xerolls fall into this category in Utah.

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. Aquolls, Argids, Calcids, Cambids, Cryalfs, Cryepts, Cryolls, Fluvents, Gypsids, Orthents, Udolls, Ustalfs, Ustepts, Ustolls, Xerands, Xerepts, and Xerolls fall into this category in Utah.

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

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). Aquents, Aquolls, Argids, Calcids, Cambids, Cryepts, Cryolls, Durids, Fluvents, Orthents, Psamments, Rendolls, Salids, Saprists, Torrerts, Udalfs, Ustalfs, Ustepts, Ustolls, Xeralfs, and Xerolls fall into this category in Utah.

16.1.2.6. Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015f). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is

[24] 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.
[25] 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).

eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public safety hazard (NRCS, 1996a). Table 16.1.2-3 provides a summary of the erosion potential for each soil suborder in Utah. Soils with medium to high erosion potential in Utah include those in the Aquents, Aquepts, Aquolls, Argids, Calcids, Cambids, Cryalfs, Cryepts, Cryolls, Durids, Fluvents, Gypsids, Orthents, Psamments, Rendolls, Salids, Saprists, Torrerts, Udalfs, Udolls, Ustalfs, Ustepts, Ustolls, Xeralfs, Xerands, Xerepts, and Xerolls suborders, which are found throughout the state (Figure 16.1.2-2).

16.1.2.7. Soil Compaction and Rutting

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

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (Natural Resources Conservation Service, 1996b). Table 16.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Utah. Soils with the highest potential for compaction and rutting in Utah include those in the Aquents, Aquepts, Aquolls, Salids, and Saprists suborders, which are found throughout the state (Figure 16.1.2-2).

16.1.3. Geology

16.1.3.1. 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 16.1.4), Human Health and Safety (Section 16.1.15), and Climate Change (Section 16.1.14).

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

- Section 16.1.3.3, Environmental Setting: Physiographic Regions and Provinces[26, 27]
- Section 16.1.3.4, Surface Geology
- Section 16.1.3.5, Bedrock Geology[28]
- Section 16.1.3.6, Paleontological Resources[29]
- Section 16.1.3.7, Fossil Fuel and Mineral Resources
- Section 16.1.3.8, Geologic Hazards[30]

16.1.3.2. 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 16.1.3-1 below.

Table 16.1.3-1: Relevant Utah Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Utah Code Annotated Section 63-73-17	Utah Geological Survey	Vertebrate fossils may not be collected without a permit; invertebrate and plant fossils may be collected on state lands with a permit. Any finding of a vertebrate fossil on state lands must be reported to the Utah Geological Survey and the School and Institutional Trust Lands Administration[a]
Building Codes	Local Agencies	Check county, city, and other local agencies for seismic guidelines in building codes[b]

[a] (School and Institutional Trust Lands Administration, 2015)

[b] Examples include: (Salt Lake City, 2015) (City of Grantsville, 2015)

16.1.3.3. Environmental Setting: Physiographic Regions and Provinces

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

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

Utah is within two physiographic regions: the Rocky Mountain System (including the Middle Rocky Mountains and the Wyoming Basin Provinces) and the Intermontane Plateaus (including the Colorado Plateaus, Basin and Range, and Columbia Plateau Provinces) (Figure 16.1.3-1) (USGS, 2003b). The locations of these regions and their provinces are shown in Figure 16.1.3-1, and their general characteristics summarized in the following subsections.

Rocky Mountain System

The Rocky Mountains form a line from the northern border with Canada south into central New Mexico. The Rocky Mountains were created during the Laramide orogeny,[31] which occurred between 70 and 40 million years ago (MYA).[32] They formed due to the collision of the Pacific Ocean oceanic crust[33] 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, the Rocky Mountains were formed several hundred miles further inland than is normally observed. (USGS, 2014b)

As reported above, the Rocky Mountain System Region within Utah is composed of two physiographic provinces: the Middle Rocky Mountains and Wyoming Basin.

<u>Middle Rocky Mountains</u> – Within Utah, the Middle Rocky Mountains includes the northeastern portion of the state and two distinct mountain ranges: the north-south oriented Wasatch Range and the east-west oriented Uinta Mountains. The Wasatch Range was created between 17 and 12 MYA, and is characterized by “granitic[34] intrusions, eroded thrust sheets,[35] and [older] sedimentary[36] rocks” (Milligan, 2000). Most peaks within the range are between 9,000 and 10,000 feet above sea level (ASL). The highest peak in this range is Mount Nebo at 11,877 feet (Halleran, 2014). The Uinta Mountains were created between 65 and 60 MYA and top out at over 13,000 feet ASL (Milligan, 2000).

[31] Orogeny: “An episode of mountain building and/or intense rock deformation” (USGS, 2015e).
[32] 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.
[33] Crust: “The rocky, relatively low density, outermost layer of the Earth” (USGS, 2015e).
[34] Granite: “A coarse-grained intrusive igneous rock with at least 65% silica. Quartz, plagioclase feldspar and potassium feldspar make up most of the rock and give it a fairly light color” (USGS, 2015e).
[35] Thrust Plate: “Slab of rock, generally on the scale of a mountain or more, bounded by two thrust faults” (USGS, 2015e).
[36] Sedimentary Rocks: “Sedimentary rocks are formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding” (USGS, 2015e).

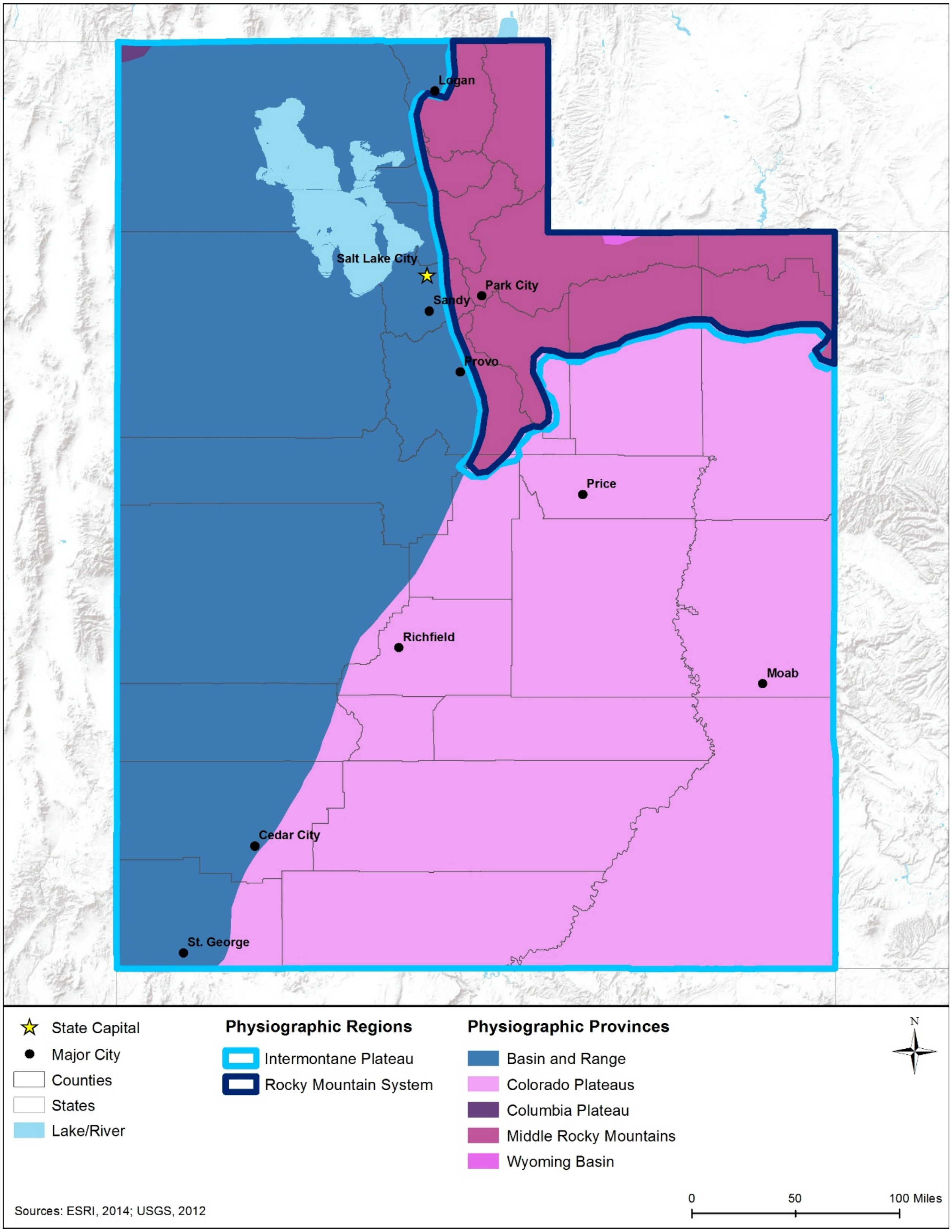


Figure 16.1.3-1: Physiographic Regions, Provinces, and Sections of Utah

Wyoming Basin – The Wyoming Basin includes a very small portion of eastern Summit County in northeastern Utah, along the border with Wyoming (USGS, 2015f). 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,[37] cuestas,[38] and numerous basins that are separated by mountains of varying size." (NPS, 2014a).

Intermontane Plateaus Region

The Intermontane Plateau Region describes the area between the Rocky Mountains and the Sierra Nevada and Cascade Ranges. The Intermontane Plateau Region dates to 80 MYA and predates the younger Rocky Mountain System to the east (which was created roughly 60 MYA). The region is characterized by interspersed higher-elevation plateaus and mountains and lower-lying basins. The Colorado and Columbia Plateaus are major elevated areas in the region, while the Basin and Range geologic province includes the region's lowest elevations. (Lew, 2004)

Colorado Plateaus – The Colorado Plateaus Province includes much of eastern Utah south of the Rocky Mountains (USGS, 2015f). This province is characterized by "a thick sequence of largely undeformed, nearly flat-lying sedimentary rocks" interspersed by dramatic rock formations attributable to erosion (Milligan, 2000). These rocks span hundreds of millions of years across both the Paleozoic and Mesozoic Eras (USGS, 2014a). The Colorado Plateaus Province was uplifted more than a mile starting 20 MYA. "As the land rose, the streams responded by cutting ever deeper stream channels," producing the region's characteristic canyons (USGS, 2014a). The Little Rockies, which are part of the Colorado Plateau Province, have visually distinctive geologic features which are discussed further in Section 16.1.8.6, Visual Resources, Natural Areas.

Canyons near the Confluence of the Green and Colorado Rivers

Source: (USGS, 2014a)

Basin and Range Province – The Basin and Range Province includes much of western Utah west of the Rocky Mountains and Colorado Plateaus (USGS, 2015f). Within Utah, the Basin and Range Province is characterized by "steep, narrow, north-trending mountain ranges separated by

[37] Hogback: "A sharp-crested, symmetric ridge formed by highly tilted resistant rock layers; a type of homocline produced by differential erosion of interlayered resistant and weak rocks with dips greater than about 25° (or approximately > 45 % slopes)" (NRCS, 2015g).
[38] Cuesta: "An asymmetric ridge capped by resistant rock layers of slight to moderate dip, commonly less than 10º (approximately < 15 percent); a homocline type produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope), that roughly parallels the inclined beds, and on the opposite side has a relatively short, steep or cliff-like slope (scarp slope) that cuts the tilted rocks" (NRCS, 2015g).

wide, flat, sediment-filled valleys." Over the course of hundreds of millions of years, sediments from the surrounding mountains have been slowly filling in the basins (Milligan, 2000). An additional unique characteristic of this area is that it is a closed basin (i.e., "[The] region's surface water sources evaporate or percolate before [they] can flow to the ocean.") (USGS, 2014c).

Columbia Plateaus – The Columbia Plateau Province includes a small portion of northwestern Utah. The Columbia Plateau is noted for containing widespread Miocene (23 to 5.3 MYA) basalt[39] fields that date to within the last 17 million years (NPS, 2014b).

16.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[40] 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,[41] subsidence,[42] and erosion. (Thompson, 2015)

Utah's surface topography is largely attributable to the uplift of the Colorado Plateaus Province during the last 70 million years. "Uplift of the Colorado Plateaus steepened stream gradients and accelerated the downcutting of the Colorado River and its principal tributaries." This resulted in the subsequent erosion of uppermost rocks and exposure of older sedimentary rocks and underlying igneous[43] and metamorphic[44] rocks (USGS, 2015f). Many of the eroded sediments have been deposited in the low-lying areas of the Basin and Range Province. Similarly, uplift of the Uinta Mountains within the Middle Rocky Mountains also created steeper river gradients resulting in accelerated erosion and removal of upper rock units (Atwood, 2014). Figure 16.1.3-2 depicts the main surficial composition of Utah.

[39] Basalt: "A dark, fine-grained, extrusive (volcanic) igneous rock with a low silica content (40% to 50%), but rich in iron, magnesium, and calcium" (USGS, 2015e).
[40] Till: "An unsorted and unstratified accumulation of glacial sediment, deposited directly by glacier ice. Till is a heterogeneous mixture of different sized material deposited by moving ice (lodgement till) or by the melting in-place of stagnant ice (ablation till). After deposition, some tills are reworked by water" (USGS, 2013a).
[41] Slope failure: "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).
[42] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000).
[43] Igneous Rocks: "Rock formed when molten rock (magma) that has cooled and solidified (crystallized) " (USGS, 2015e).
[44] Metamorphic Rocks: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids" (USGS, 2015e).

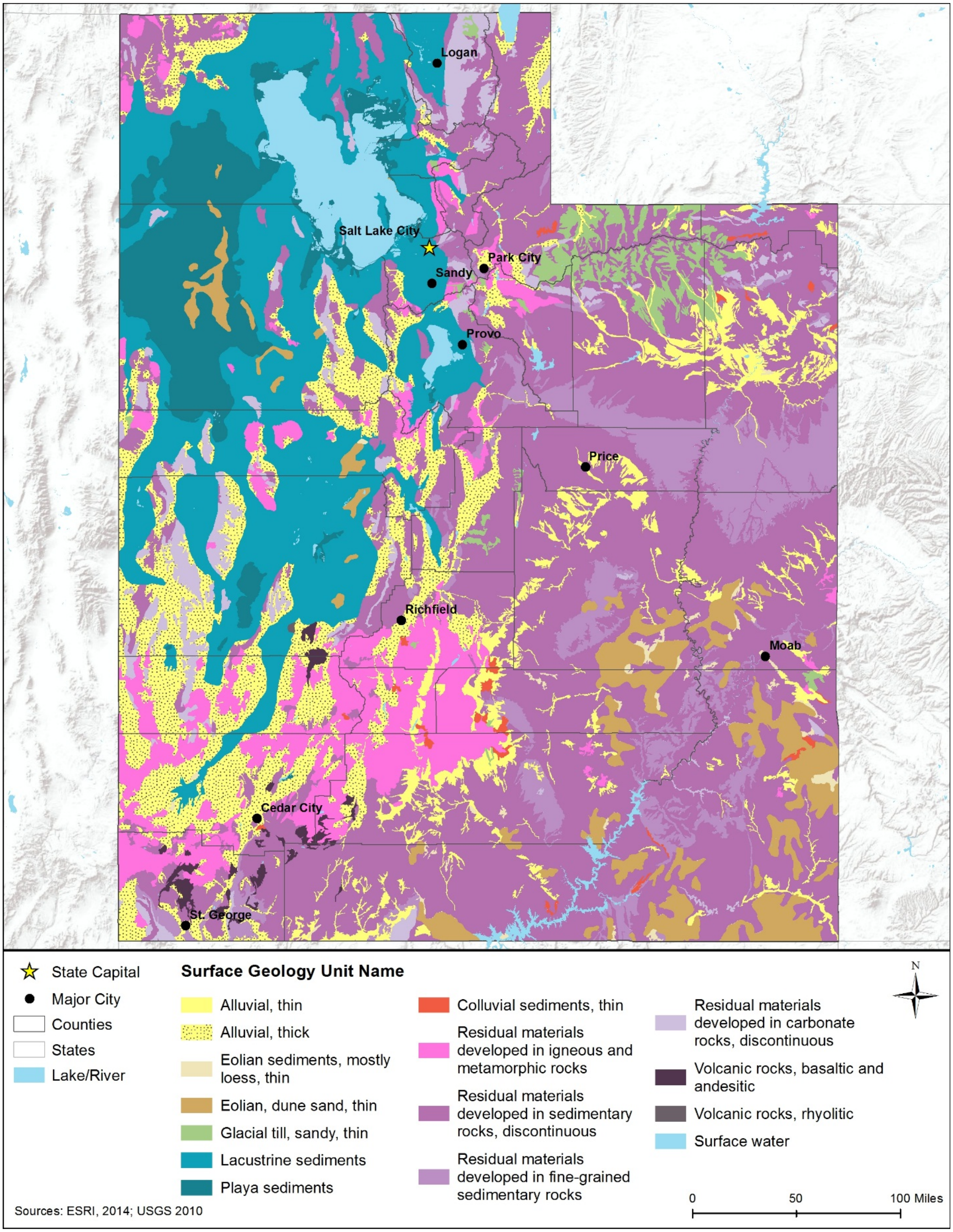


Figure 16.1.3-2: Generalized Surface Geology for Utah

16.1.3.5. 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., 3-dimensional geometry), including dip (slope of the formation),[45] rock composition, and regional tectonism.[46] 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).

Utah's oldest bedrock is more than 2.5 billion years old. Those rocks, mostly in the northern part of the state, changed into metamorphic rock after exposure to heat and pressure. Additional layers of rock were deposited on these basement rocks for the next 800 million years and are exposed along the eastern end of the Uinta Mountains, and the Raft River and Wasatch Ranges (Atwood, 2014). Tectonic activity has created alternating structural basins, including the Uinta basin in the northeastern part of the state, and ridges. "Basins generally contain an underlying, relatively undeformed sequence of rock that was deposited in the area prior to uplift and an overlying younger layer of rock and sediment that was derived from the erosion of nearby uplifted areas." The Basin and Range Province "formed by block faulting, [which describes a sequence where] a block of the Earth's crust was displaced downward with respect to adjacent uplifted blocks." The Basin and Range is underlain by older volcanic and sedimentary rocks, and topped by a thick sequence of Tertiary and Quaternary-aged sediment. (USGS, 2015f)

Quaternary (2.6 MYA to present) deposits are found in the northern and western portions of the state, and southern Utah has Cretaceous (146 to 66 MYA), Jurassic (200 to 146 MYA), and Triassic (251 to 200 MYA) sedimentary rock, along with Quaternary and Tertiary (66 to 2.6 MYA) volcanic rock. Southeastern Utah geology includes Jurassic and Triassic sedimentary rock, and Permian (299 to 251 MYA) and Pennsylvanian (318 to 299 MYA) sedimentary rock. Northeast Utah geologic units include Tertiary sedimentary rock, and undifferentiated Lower Paleozoic and Precambrian (older than 542 MYA) rocks. Figure 16.1.3-3 displays the general bedrock geology for Utah.

[45] 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).
[46] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust" (USGS, 2016b).

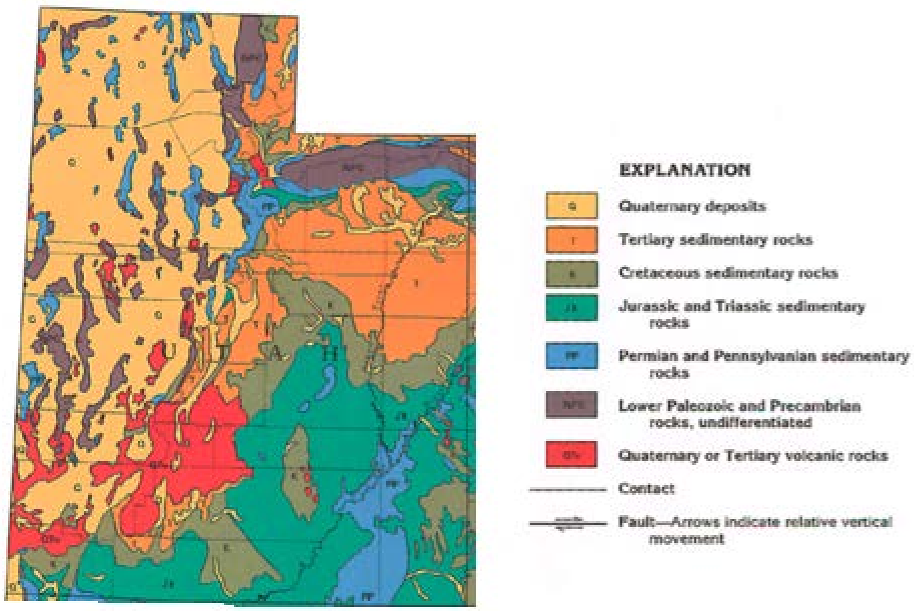


Figure 16.1.3-3: Generalized Bedrock Geology for Utah

Source: (USGS, 1995a)

16.1.3.6. Paleontological Resources

Utah was underwater during much of the Paleozoic Era (542 to 251 MYA). Rocks from the Carboniferous Period (359 to 299 MYA) are particularly abundant with fossils from marine invertebrates. During the Mesozoic Era (251 to 66 MYA), the sea receded from eastern Utah, but the western part of the state remained covered by a shallow sea, as evidenced by the presence of marine fossils. Dinosaur footprints from this timeframe are common in ancient floodplains. During the Cenozoic Era (66 MYA to present), ancient freshwater lakebeds in the central part of the state have yielded extensive animal fossils. (Paleontology Portal, 2015).

Utah State Fossil
Allosaurus

Source: (Utah State Library, 2014)

Utah's marine invertebrate fossils from the Paleozoic Era consist of algae, brachiopods,[47] bryozoans,[48]

[47] 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).

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

cephalopods,[49] corals, conodonts,[50] echinoderms,[51] graptolites, trilobites,[52] and sponges. Rare primitive jawed and jawless fish have also been recovered from that time. Marine fossils from the Triassic Period (251 to 200 MYA) have been in the western part of the state; they include ammonoids, brachiopods, clams, and snails. In eastern Utah, terrestrial rocks from the Triassic Period contain fossils from amphibians, bony fish, freshwater sharks, lizards, and early dinosaurs (Paleontology Portal, 2015). Dinosaur footprints are abundant throughout southern and central Utah (Bureau of Land Management , 2011). Jurassic Period (200 to 146 MYA) fossils include vertebrate and invertebrate footprints; marine fossils such as ammonoids, brachiopods, clams, ichthyosaurs, and snails; and fossils of amphibians, fish, reptiles, and dinosaurs, including the Allosaurus, the state fossil of Utah. Marine fossils from the Cretaceous Period (146 to 66 MYA) include large clams, fish, and marine reptiles. Terrestrial fossils include eggs, mammals, lizards, and dinosaurs such as the Tyrannosaurs rex. Utah's Tertiary Period (66 to 2.6 MYA) fossil record includes fossils of large mammals, reptiles, fish, invertebrates, and birds, and Quaternary (2.6 MYA to present) fossils include bison, giant ground sloths, musk ox, and saber-toothed cats (Paleontology Portal, 2015).

16.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

In 2013, Utah produced more than 34.9M barrels of oil, ranking 11th nationwide in total production (EIA, 2016); Utah produces approximately 1 percent of crude oil in the United States. Most of Utah's oil production is based out of the northeastern portion in the Uinta Basin[53] (U.S. Energy Information Administration, 2014a). The Uinta Basin's Monument Butte, Alamont-Bluebell, and Greater Aneth oil fields are three of the top 100 oil-producing fields in the country. (Utah Department of Natural Resources, 2015)

In 2014, Utah produced 453,207 million cubic feet of natural gas, accounting for 1.7 percent of total nationwide output. Most of Utah's natural gas production is based out of the Uinta Basin; coalbed methane has proven to be a valuable source of natural gas, accounting for nearly a third of the state's natural gas output (U.S. Energy Information Administration, 2014a). Utah's top natural gas fields are the Natural Buttes, Chapita Wells, and Red Wash fields (Utah Department of Natural Resources, 2015).

[49] Cephalopod: "Any mollusk of the class Cephalopoda, which includes squids, octopus, and ammonites. They are characterized by the tentacles attached to their heads" (Smithsonian Institution, 2016).
[50] Conodonts: "Any member of a group of worm-like, vertebrate organisms common from the Ordovician to the Triassic. Conodont dental batteries are important tools for Paleozoic and early Mesozoic biostratigraphy" (Smithsonian Institution, 2016).
[51] Echinoderm: "Common name for members of the phylum Echinodermata. These organisms are characterized by bodies showing radial symmetry (usually in fives) and the presence of tube feet in most forms" (Smithsonian Institution, 2016).
[52] 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).
[53] The Uinta Basin is in the eastern portion of the state, southeast of Salt Lake City.

Minerals

As of 2015, Utah's total nonfuel mineral production was valued at more than $2.9 billion, ranking 8th nationwide (in terms of dollar value), and accounting for almost four percent of the country's total nonfuel mineral production (USGS, 2016a). As of 2015, Utah's leading nonfuel mineral commodities were molybdenum concentrates, copper, magnesium metal, potash, and salt. Utah is also the country's only producer of beryllium and magnesium metal. Other minerals produced in the state include silver, bentonite, lime, common clay, gypsum, construction sand and gravel, gemstones, crushed stone, cement, dimension stone[54], perlite, rhenium, and sulfur (USGS, 2015d).

In 2013, Utah produced 16,977 thousand short tons of coal, accounting for 1.7 percent of total nationwide production. The Uinta Basin in the eastern portion of the state is a major source of coal (U.S. Energy Information Administration, 2014b). Utah has seven active coal mines that include more than 83,000 acres (BLM, 2015d).

16.1.3.8. Geologic Hazards

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

Earthquakes

Between 1973 and March 2012, there were 14 earthquakes of a magnitude 4.5 (on the Richter scale[55]) or greater in Utah (USGS, 2014j). Earthquakes are the result of large masses of rock moving against each other along fractures called faults. Earthquakes occur when landmasses on opposite sides of a fault suddenly slip past each other; the grinding motion of each landmass sends out shock waves. The vibrations travel through the Earth and, if they are strong enough, they can damage manmade structures on the surface (USGS, 2012b).

The shaking due to earthquakes can be significant many miles from its point of origin depending on the type of earthquake and the type of rock and soils beneath a given location. Crustal earthquakes, the most common types of earthquakes to occur in Utah, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale. Subduction zone earthquakes occur where Earth's tectonic plates collide. When tectonic plates collide, one plate slides beneath the other, where it is reabsorbed into the mantle of the earth (USGS, 2014e). Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale (Oregon Department of Geology 2015). Utah is far from any convergence boundaries.

Figure 16.1.3-4 depicts the seismic risk throughout Utah; the box surrounding the range of colors shows the seismic hazards in the state. The map indicates levels of horizontal shaking (measured

[54] Dimension stone: "Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape" (USGS, 2016c).
[55] 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).

in Peak Ground Acceleration (PGA)) that have a two 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 Utah are focused in the central portion of the state running from north to south (Figure 16.1.3-4). More specifically, Weber, Davis, Salt Lake, Utah, and Juab Counties are at the greatest risk of strong earthquakes within the state. This area corresponds to the location of the Wasatch Fault,[56] a 240-mile long geologic feature that extends between Malad City, ID, and Fayette, UT. Over the last 6,000 years, this fault has produced at least 19 earthquakes that have caused ground surface ruptures in Utah (Utah Geological Survey, 1997).

On average, six magnitude 3.0 (or greater) earthquakes occur within Utah in a given year. Magnitude 6.0 (or greater) earthquakes occur in Utah, on average, once every 20 years (Utah Geological Survey, 1997). The largest earthquake recorded in Utah measured 6.6 on the Richter scale in Hansel Valley (northern Utah) in 1934. The earthquake produced landslides and multiple fractures in the ground; in some locations, the terrain was displaced by more than a foot (USGS, 2014f).

Landslides

The potential for exists for damaging landslides throughout parts of Utah. In 2005, Utah suffered more than $10 million in damages due to landslide events (Beukelman, 2011).

"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, 2003a). Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale. (USGS, 2003a)

[56] Fault: "A fracture in the Earth along which one side has moved in relative to the other" (USGS, 2015e) .

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

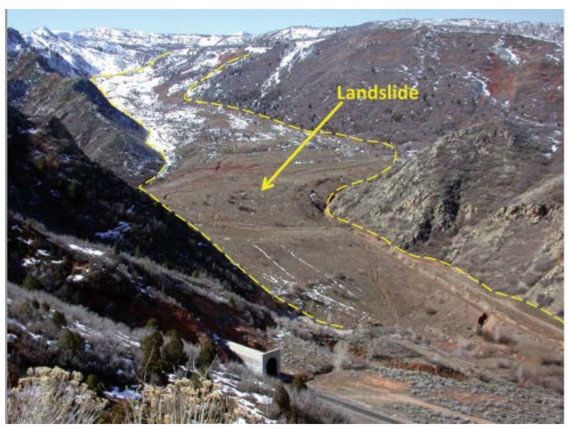
Landslides are most common in portions of Utah within the Southern Rocky Mountains and Colorado Plateau Provinces. These portions of Utah are most susceptible to landslides because they contain "weak rock types, steep slopes, and the highest annual precipitation in the state." As of 2010, more than 22,000 individual landslide events had been recorded throughout the state. The 1983 Thistle Landslide (discussed in further detail in the call-out box to the right) is one of the largest landslides ever recorded nationwide. (Beukelman, 2011)

Figure 16.1.3-5 shows landslide incidence and susceptibility throughout Utah.

Significant Landslide Event: 1983 Thistle (UT) Landslide

The most economically damaging landslide ever recorded nationwide occurred near the town of Thistle, UT, in spring 1983. The landslide is attributed to heavy precipitation in during the preceding fall of 1982, followed by rapid snowmelt which saturated the underlying terrain. The "landslide ultimately reached 1000 feet in width, nearly 200 feet in thickness, and over one mile in length" (Milligan, M., 2005). A lake formed behind the landslide and threatened to bury the town in sediment. Ultimately, Thistle was abandoned. "The landslide destroyed U.S. Highway 89 and the adjacent Denver and Rio Grande Western railroad Tracks" (Beukelman, 2011). A photo of the 1983 Thistle Landslide is included below.

1983 Thistle Landslide



Source: (Beukelman, 2011)

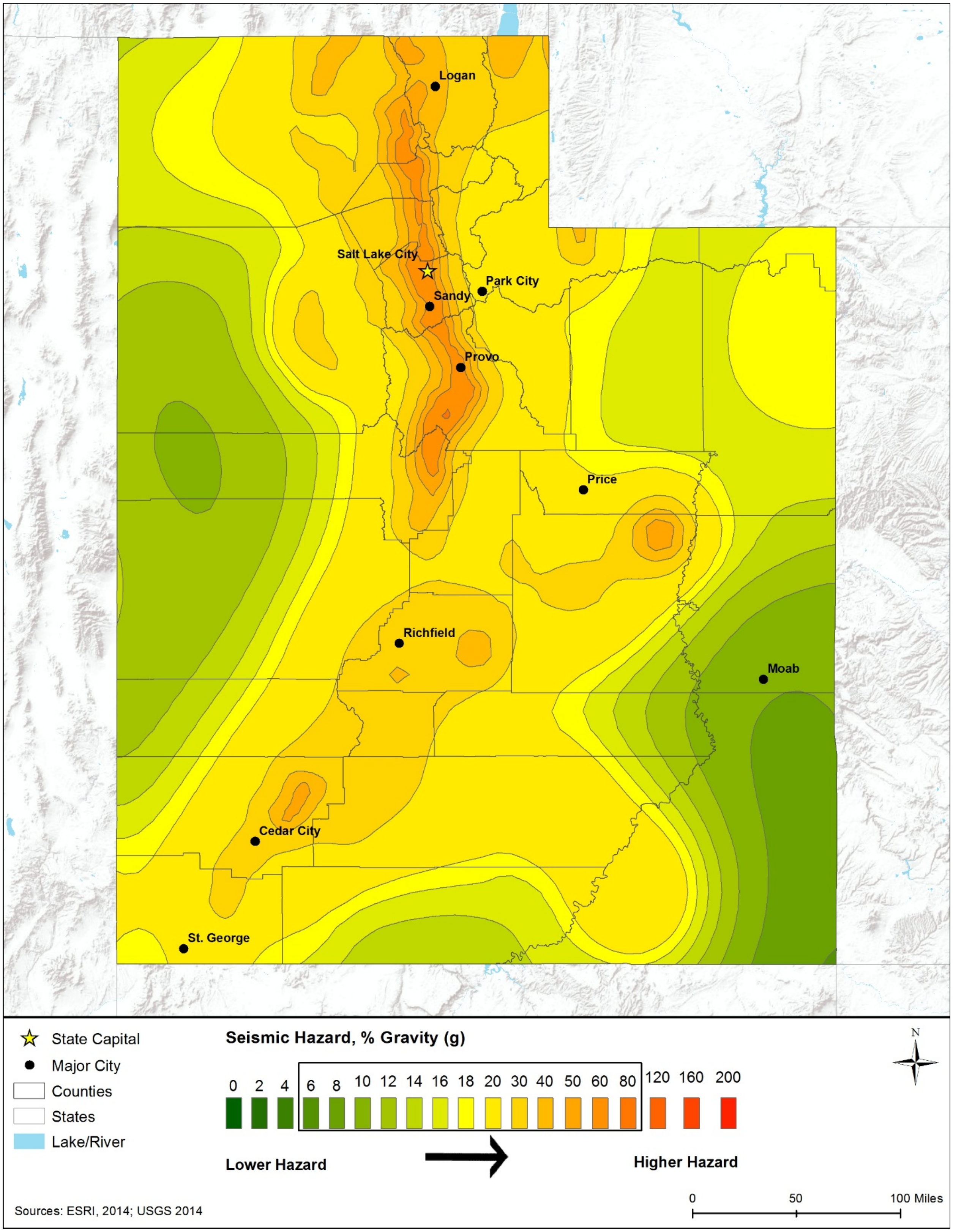


Figure 16.1.3-4: Utah 2014 Seismic Hazard Map

Land Subsidence

Land subsidence is a “gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials.” Utah is particularly susceptible to land subsidence due to aquifer compaction from the overuse of groundwater (Leake, 2013). Nationwide, the main triggers of land subsidence can be aquifer compaction, drainage of organic soils, mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the United States is due to over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains (USGS, 2000). 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, 2013b). In Utah, land subsidence due to groundwater extraction and subsequent aquifer compression has been documented throughout the southwestern part of the state (Lund, Knudsen, Inkenbrandt, & Lowe, 2011). In Enoch City (60 miles northeast of St. George in the southwestern corner of the state), the Utah Geological Survey (UGS) “found a 2.4-mile-long earth fissure that had formed in response to land subsidence caused by ground-water overdraft of the local aquifer.” Since 1950, ground throughout this area has subsided by about four feet (Lund, Knudsen, Inkenbrandt, & Lowe, 2011). In rural areas of Utah’s Escalante Desert (in the southwestern corner of the state), land subsidence also has been attributed to overuse of groundwater resources. Near Beryl Junction (in the southwestern corner of the state), ground subsidence was been documented at four feet between 1941 and 1972. Land subsidence in southwestern Utah has formed fissures that are visible at the land surface and often measure more than a mile in length (Lund, et al., 2005).

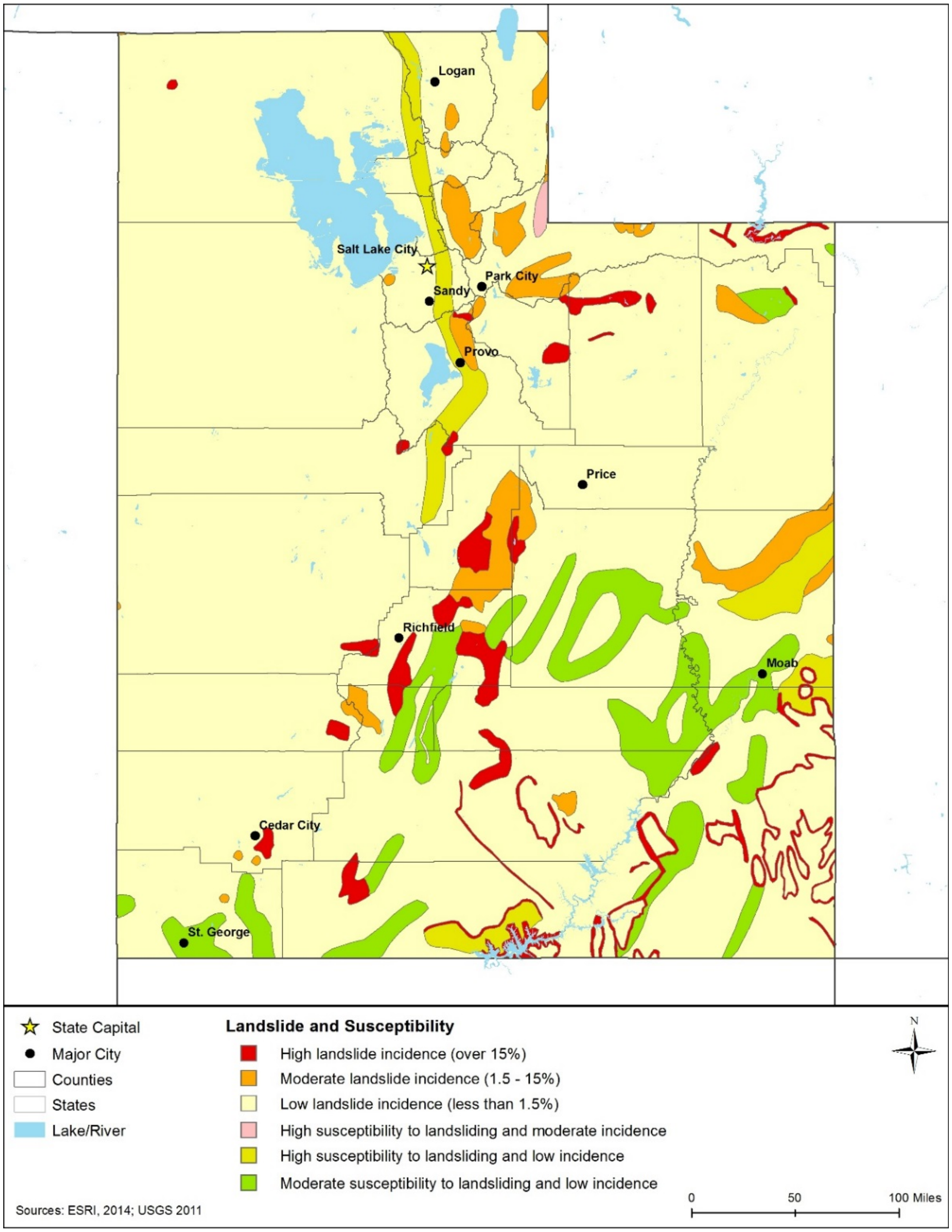


Figure 16.1.3-5: Utah Landslide Incidence and Susceptibility Hazard Map[57]

[57] Susceptibility hazards not indicated in Figure 16.1.3-5 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated. (USGS, 2014e).

16.1.4. Water Resources

16.1.4.1. Definition of the Resource

Water resources are defined as all surface waterbodies and groundwater systems including streams, rivers, lakes, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 16.1.5). These resources can be grouped into watersheds, which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for available water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human health, economic wellbeing, and ecological health (USGS, 2014g).

16.1.4.2. 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 16.1.4-1 identifies the relevant laws and regulations for water resources in Utah.

Table 16.1.4-1: Relevant Utah Water Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Utah Pollutant Discharge Elimination System (UPDES) Program	Utah Department of Environmental Quality (UDEQ)	Construction activities that disturb one or more acre of soil (UDEQ, 2013a).
Water Rights Law Index	Utah Division of Water Rights	Summary of all water rights laws in Utah (Utah Division of Water Rights, 2014).
Clean Water Act (CWA) Section 404 permit, Nationwide Permit, Utah regional conditions	U.S. Army Corps of Engineers (USACE), Sacramento District	Pre-construction notification is required for any dredge and fill activities in surface waters below 4,217 feet elevation adjacent to the Great Salt Lake and below 4,500 feet elevation adjacent to Utah Lake (USACE, 2012).
CWA Section 401 permit	UDEQ	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 UDEQ indicating that the proposed activity will not violate water quality standards (UDEQ, 2015e).

16.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams. In Utah, there are approximately 89,000 miles of rivers and streams, and over 2,000 ponds and lakes. The Great Salt Lake is the 6th largest lake nationwide, and is three to five times more saline than the ocean (Utah State University, 2015). Other large lakes in Utah include Lake Powell, Sevier Lake, and Utah Lake. Drinking water in Utah typically comes from surface water and wells for larger cities, while smaller communities usually depend on springs and wells. There are over 1,800 drinking water sources in the state (UDEQ, 2015j).

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains streams and rainfall to a common outlet (e.g., reservoir, bay). Utah's waters (lakes, rivers, and streams) are divided into 10 major watersheds (Figure 16.1.4-1). The Great Salt Lake, Western Colorado, and Weber River Watersheds are discussed further below, and are representative of the types of watersheds found in Utah.

The Great Salt Lake Watershed includes much of western Utah, and extends west from the Great Salt Lake to beyond the state's border with Nevada. This basin encompasses nearly 19,000 square miles, and contains some of the nation's most arid lands, with scarce and often intermittent water resources (DNR, 2001a). The lake itself is approximately 75 miles long and 35 miles wide, with a maximum depth of roughly 33 feet. The Great Salt Lake is terminal, and receives water from surface water (66 percent) including four main rivers (Bear, Weber, Ogden, and Jordan rivers) and many small streams, direct precipitation (31 percent), and groundwater (three percent); yearly inflows equate to roughly three million acre-feet of water. Water in the lake is primarily lost from evaporation (UGS, 2015).

The Western Colorado Watershed, in south-central Utah, encompasses approximately 15,000 square miles. It includes the stretch of Colorado River from its confluence with the Green River, to the eastern shore of Lake Powell, and includes the entire reservoir. This watershed has a variety of climates and topography, with elevations ranging from 3,700 feet to over 11,500 feet, and precipitation variations of 30 inches to no more than 8 inches per year. (DNR, 2000)

The Weber River Watershed is in north-central Utah, and includes the majority of the Wasatch Range and the Uinta Mountain northwest slopes. It not only receives more average precipitation than any other watershed in the state (26 inches per year), but it is also one of the most developed. Waters in this basin are used for agricultural purposes and as the drinking water supply for a significant amount of the state's population. (DNR, 2009)

Freshwater

As shown in Figure 16.1.4-1, the major river in Utah is the Colorado River, along with its tributaries, the Green and San Juan Rivers. The Colorado River supplies industrial and municipal water to nearly 30 million people in the western United States, and provides irrigation water for nearly four million acres of land (BOR, 2015). The Colorado River in Utah, as well as the Green River, is also highly regarded for their recreation and scenic values (DNR, 2001b). Salinity is a major concern for the river. Much of the land in the Colorado River Basin is underlain by the Mancos Shale formation, a highly saline formation from which many soils are formed. When these lands are irrigated, salts are turned into solution and carried into surface water. In 1974, Congress enacted the Colorado River Basin Salinity Control Act. This program is administered by the Bureau of Reclamation (BOR, 2015). Another issue are several endangered native Colorado River fish species. The Upper Colorado River Endangered Fish Recovery Program, as well as the San Juan River Basin Recovery Implementation Program, are in place to recover these fish populations while still allowing for development of the water supply (DNR, 2001b). For more information on these programs, visit http://www.coloradoriverrecovery.org/.

Fed by the Provo River, Utah Lake is the largest freshwater lake in Utah and one of the largest in the western U.S. (Utah Division of State Parks, 2016). The lake measures 12 by 24 miles and reaches a maximum depth of 14 feet. "Natural hot springs [are common] on the south end of the lake and in the Saratoga Springs area" (UtahLake.gov, 2011).

Bear Lake is located on the northern Utah boarder with Idaho. More than half of the 110 square mile lake is located within Utah. The total length of the lake is 20 miles and the width is more than seven miles. The maximum depth of the lake is 208 feet, with the average depth being 94 feet. The Bear River is the main surface water source of inflow and outflow while groundwater also recharges the lake. (Davis, 2011)

Lake Powell is approximately 180 miles long, covering an area of 160,000 acres. Its shoreline is nearly 2,000 miles long, and at full capacity, stores 27 million acre-feet of water. The reservoir was created in 1963 as water impounded behind Glen Canyon Dam, and is part of the Glen Canyon National Recreation Area. It receives water from the Colorado, San Juan, and Escalante rivers (DOW, 2015). Aquatic invasive species continue to threaten the aquatic food web by removing plankton and clogging water intake pipes (National Invasive Species Information Center, 2015). Other nonnative species, along with grazing, sedimentation, and hydrologic alteration (including water flows dictated by the Colorado River Compact) can all affect the water quality and quantity of the lake (NPS, 2015a).

16.1.4.4. Sensitive or Protected Waterbodies

Wild and Scenic Rivers

Nearly 170 miles of the Virgin River and its tributaries within Zion National Park and adjacent Bureau of Land Management Wilderness (Figure 16.1.4-1) has been designated a National Wild and Scenic River in Utah. The river's riparian areas contain prehistoric American Indian Sites and habitat for many species and rare plant communities. (National Wild and Scenic Rivers System, 2016)

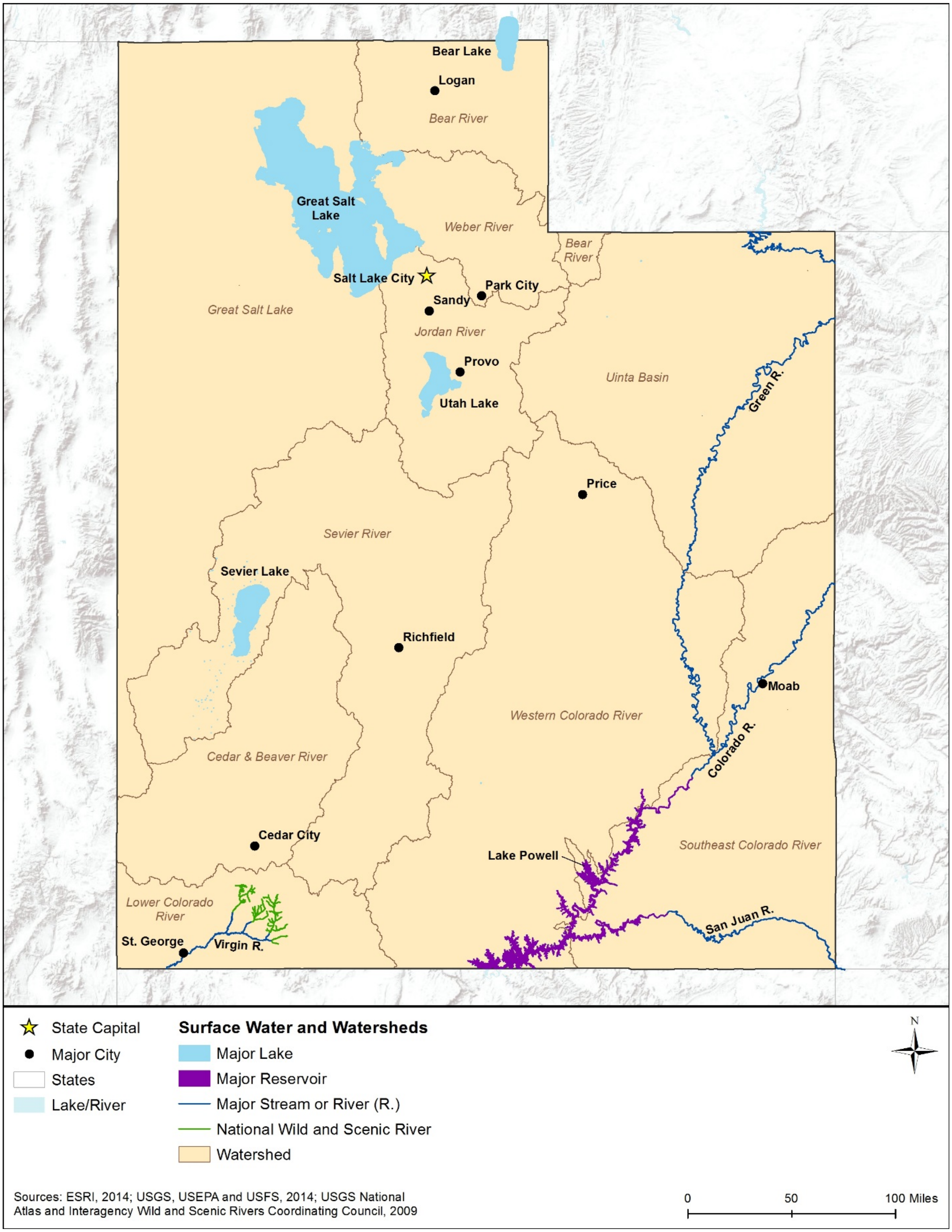


Figure 16.1.4-1: Major Utah Watersheds and Surface Waterbodies

16.1.4.5. Impaired Waterbodies

Several elements, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, observations of aquatic wildlife communities, and sampling of fish tissue, are used to evaluate water quality. Under Section 303(d) of the Clean Water Act, states are required to assess water quality and report a listing of impaired waters,[58] the causes of impairment, and probable sources. Table 16.1.4-2 summarizes the water quality of Utah's assessed major waterbodies by category, percent impaired, designated use,[59] cause, and probable sources. Figure 16.1.4-2 shows the Section 303(d) waters in Utah as of 2014.

As shown in Table 16.1.4-2, various sources affect Utah's waterbodies, causing impairments. Approximately one-third of Utah's assessed rivers and streams and lakes, reservoirs, and ponds are impaired. Designated uses of the impaired rivers and streams include agricultural, cold and warm water aquatic life, domestic water supply, non-game fish and other aquatic life, secondary recreation, and wildlife habitat. Designated uses of the impaired lakes, reservoirs, and ponds include agricultural and cold and warm water aquatic life (USEPA, 2015b).

Table 16.1.4-2: Section 303(d) Impaired Waters of Utah, 2014

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	12%	34%	agricultural, cold and warm water aquatic life, domestic water supply, non-game fish and other aquatic life, secondary recreation, wildlife habitat	benthic macroinvertebrate bioassessments, total phosphorus, water temperature, total dissolved solids	Agriculture, natural sources, minor industrial point sources, habitat modification
Lakes, Reservoirs, and Ponds	97%	33%	agricultural, cold and warm water aquatic life	total phosphorus, total dissolved solids, PCB(s) in fish tissue, dissolved oxygen	Managed pasture grazing, irrigated crop production, animal feeding operations, municipal and industrial point source discharges

Source: (USEPA, 2015b)
[a] Some waters may be considered for more than one water type.
[b] Utah has not assessed all waterbodies within the state.

[58] 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, 2015m).
[59] 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, 2015m).

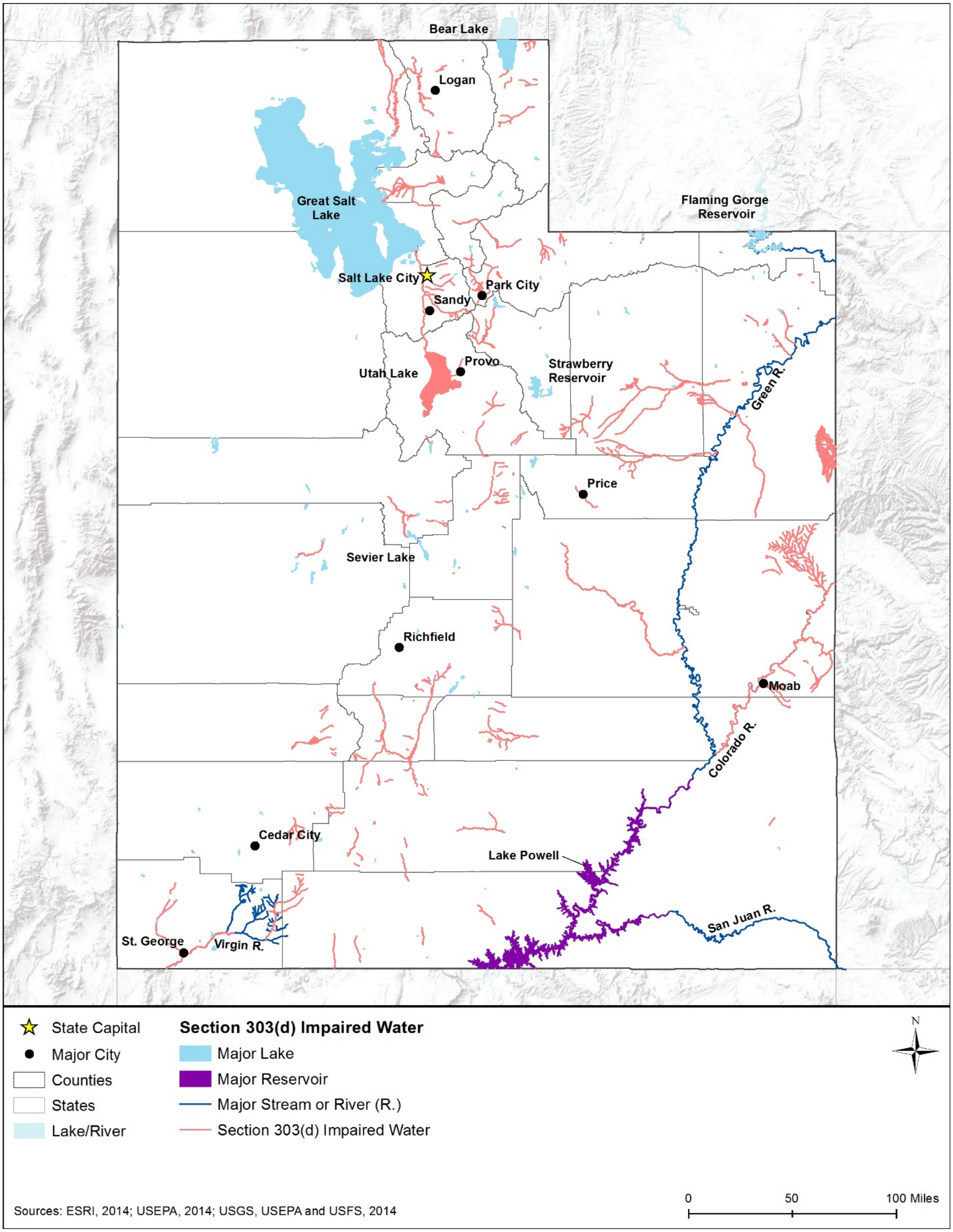


Figure 16.1.4-2: Section 303(d) Impaired Waters of Utah, 2014

Threats to surface water in the state can come from non-point sources, such as agricultural activities that can cause excess sediment, nutrients, salinity, pesticides, and pathogens to enter rivers and lakes. Urban runoff is a small source of non-point source pollution, but can be significant in localized areas. Urban runoff can carry toxins and pathogens into local surface waterbodies. Additionally, hydrologic modifications, abandoned mines, and silviculture and resulting increased erosion and sedimentation can be sources of non-point source pollution. For more information on Utah's water quality, visit UDEQ at http://www.deq.utah.gov/ProgramsServices/programs/water/wqmanagement/assessment/index.htm. (UDEQ, 2013b)

16.1.4.6. 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 one 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).

There are two primary types of floodplains in Utah: riverine and lake floodplains. Riverine floodplains occur along rivers and streams, where overbank flooding may occur. In mountainous areas, such as the Wasatch (near Salt Lake City), 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 (Utah State Floodplain Management Office, 2006). Lakes with no outlets, such as the Great Salt Lake, are referred to as closed basin lakes, and are subject to large fluctuations in water surface elevation (FEMA, 2015a).

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, 2015c). There are several causes of flooding in Utah, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. These include flooding due to rapid snowmelt in the late spring and early summer, along with intense precipitation events in the summer. Flooding resulting from watersheds damaged by wildfires is also a growing concern. The two fastest growing areas in Utah, the Wasatch Front and the southwestern corner of the state, are also the most vulnerable to flooding. These areas include Salt Lake, Washington, Utah, and Weber counties. (DPS, 2014)

2015 Southern Utah Flooding

On September 14, 2015, heavy rains caused flash flooding in the area of Hildale (Washington County) in southern Utah with 16 fatalities in the area. The floodwaters damaged roads, bridges, and road crossings and washed out a municipal water pipeline (NRCS, 2015h). This same event on September 14 also caused flash flooding in nearby Zion National Park; seven climbers in Keyhole Canyon perished during this flooding (NPS, 2015k).

USGS measuring streamflows after flash flooding in Hildale, Utah

Source: (USGS, 2015m)

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 200 communities in Utah through the National Flood Insurance Program (NFIP) (FEMA, 2014b). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015b). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, Utah had 11 communities participating in the CRS (FEMA, 2014c).[60]

16.1.4.7. 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

[60] A list of the 11 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (FEMA, 2014c) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

and springs. Groundwater is contained in either confined (bound by clays or nonporous bedrock) or unconfined (no layer to restrict the vertical movement of groundwater) aquifers (USGS, 1999). When the water table reaches the ground surface, groundwater will reappear as either streams, surface bodies of water, or wetlands. This exchange between surface water and groundwater is an important feature of the hydrologic (water) cycle.

Utah's principal aquifers consist of basin-fill aquifers, alluvial aquifers, and carbonate-rock[61] aquifers. Generally, the water quality of Utah's aquifers is good. Statewide, the most serious threats to groundwater quality include increased runoff from urban areas, mining activities including leaching from tailings,[62] and irrigation use of surface water that has depleted groundwater recharge sources. (UDNR, 2015a)

Table 16.1.4-3 provides details on aquifer characteristics in the state. Figure 16.1.4-3 shows Utah's principal and sole source aquifers.

Table 16.1.4-3: Description of Utah's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Basin and Range basin-fill aquifers Typically unconfined and not hydraulically connected, consisting primarily of unconsolidated alluvial-fan deposits	Found throughout the north and western half of the state	Generally useable, with localized dissolved solids concentrations that can exceed standards. Deep, confined basin-fill aquifers, including those in the Salt Lake Valley, are susceptible to contamination from recharge.
Pacific Northwest basin-fill aquifers Unconsolidated and semiconsolidated sand and gravel	Far northwestern corner of the state	Generally useable, with localized dissolved solids concentrations that can exceed standards. Deep, confined basin-fill aquifers are susceptible to contamination from recharge.
Colorado Plateau aquifers Sandstone aquifers	Found throughout the southern and eastern half of the state.	Groundwater quantity and quality is extremely variable; however, the water quality is generally suitable for most domestic and agricultural uses.
Basin and Range carbonate-rock aquifers Typically unconfined and not hydraulically connected, consisting primarily of unconsolidated alluvial-fan deposits	Found throughout the north and western half of the state	Suitable for most uses, although dissolved solids concentrations can be high in localized areas.

Source: (Moody, Carr, Chase, & Paulson, 1986), (USGS, 2015h), (USGS, 1995b)

[61] 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).
[62] Tailings are "residue of raw material or waste separated out during the processing of crops or mineral ores" (USEPA, 2009).

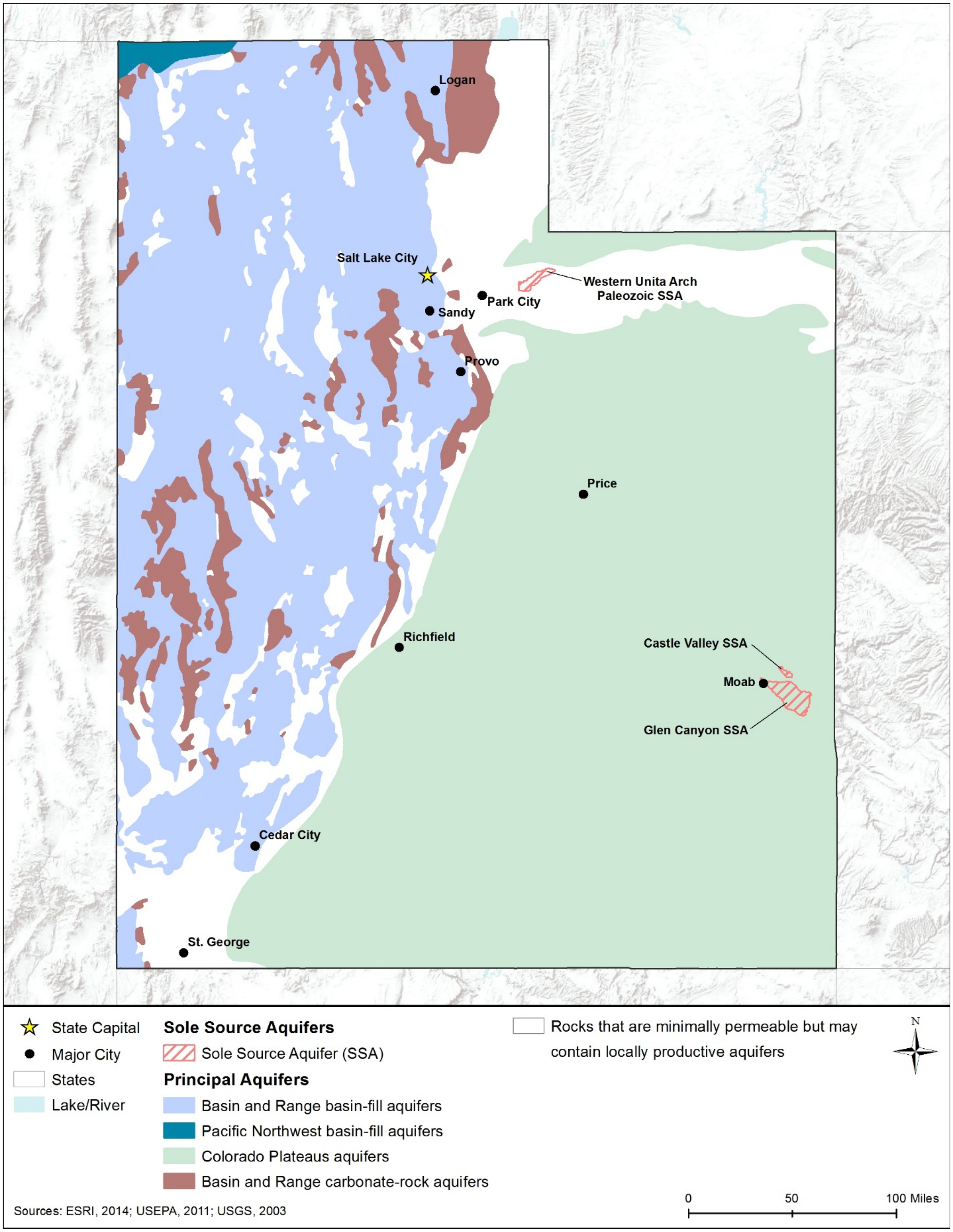


Figure 16.1.4-3: Principal and Sole Source Aquifers of Utah

Sole Source Aquifers

The USEPA defines sole source aquifers (SSAs) as an aquifer that "supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and are areas with no other drinking water sources (USEPA, 2015c). Utah has three designated SSAs within the state (as shown in Figure 16.1.4-3). The Western Uinta Arch Paleozoic SSA is near the town of Oakley, in Summit County; the Castle Valley SSA includes the town of Castle Valley in Grant County; and the Glen Canyon SSA is near the town of Moab, in Grand County (USEPA, 2015d). Designating a groundwater resource as an SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized (USEPA, 2015c).

16.1.5. Wetlands

16.1.5.1. Definition of the Resource

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

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

16.1.5.2. Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, describes the pertinent federal laws protecting wetlands in detail. Table 16.1.5-1 summarizes the major Utah state laws and permitting requirements relevant to the state's wetlands.

Table 16.1.5-1: Relevant Utah Wetland Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Clean Water Act (CWA) Section 404 permit, Nationwide Permit, Utah regional conditions	U.S. Army Corps of Engineers (USACE), Sacramento District	NWPs 12.Utility Line Activities, 33.Temporary Construction, Access, and Dewatering, and 39.Commercial and Institutional Developments

State Law/Regulation	Regulatory Agency	Applicability
		cannot be used in fens[63], bogs[64], wetlands contiguous with fens, and peatlands[65]. Activities covered under these five NWPs must submit pre-construction notification (USACE, 2012).
Utah Pollutant Discharge Elimination System (UPDES) Program	UDEQ	Construction activities that disturb one or more acre of soil (UDEQ, 2013a).
CWA Section 401 permit	UDEQ	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 UDEQ indicating that the proposed activity will not violate water quality standards (UDEQ, 2015k).

16.1.5.3. Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service's (USFWS) National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard (WCS) that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined in Cowardin et al. (1979). The WCS includes five major wetland systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine (as detailed in Table 16.1.5-2). [66] The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats. (USFWS, 2015a)

- The Marine System consists of open ocean, continental shelf, including beaches, rocky shores, lagoons, and shallow coral reefs. Normal marine salinity (saltiness) to hypersaline (more than 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."
- "Riverine System includes all wetlands and deepwater habitats contained within a channel with two exceptions (1) wetlands dominated by trees, shrubs, persistent emergents, emergent

63 Fens "are peat-forming wetlands that receive nutrients from sources other than precipitation: usually from upslope sources through drainage from surrounding mineral soils and from groundwater movement" (USEPA, 2012e).

64 Bogs are acidic wetlands that form thick organic (peat) deposits up to 50 feet deep or more. They have little groundwater influence and are recharged through precipitation (APA, 2013).

65 "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, 2015l).

66 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.

mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 ppt"

- Lacustrine System includes inland water bodies that are situated in topographic depressions, lack emergent trees and shrubs, have less than 30 percent vegetation cover, and occupy greater than 20 acres. Includes lakes, larger ponds, sloughs, lochs, bayous, etc.;
- "Palustrine includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent." The System is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types). (Cowardin, Carter, Golet, & LaRoe, 1979)

In Utah, wetlands constitute approximately 1 percent of the total landscape. Wetland types include marshes and wet meadows, playas, fens, and lake-fringe varieties (Utah Geological Survey, 2015). The largest singular wetland area in the state includes lacustrine (i.e., lake fringe) wetlands around the Great Salt Lake (Yuhas, 1996); the wetlands area surrounding the Great Salt Lake typically fluctuates between 400,000 and 500,000 acres (UDEQ, 2009). In Utah, palustrine wetlands (i.e., freshwater) are the dominant type of wetland, and are primarily found on river floodplains. Riverine wetlands comprise approximately two percent of the wetlands in the state.

Table 16.1.5-2 uses 2014 NWI data to characterize and map Utah 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 specific project locations are proposed. As shown in Figure 16.1.5-2, most palustrine wetlands are found in the northern half of the state, and lacustrine are found primarily around the Great Salt Lake. The map codes and colorings in Table 16.1.5-2 correspond to the wetland types in the figure.

Table 16.1.5-2: Utah 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, primarily in the northern half	47,701
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.	Throughout the state, primarily in the northern half	
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, primarily in the northern half	299,529

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
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, primarily in the northern half	18,413
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[67], and other miscellaneous wetlands are included in this group.	Throughout the state, primarily in the northern half	650
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	14,008
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.	Concentrated around the Great Salt Lake	212,051
Total				**592,352**

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. From 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 Utah, palustrine wetlands include freshwater emergent marshes, wet meadows or fens, and playas. Emergent marshes are usually found next to lake fringes, or edges of rivers or ponds. They are typically flooded with water, with water levels ranging from a couple of inches up to three feet. Wet meadows, or fens, are typically fed by groundwater, with a high water table. They usually have a high cover of thick grasses that makes them appear dry, but they are saturated. These wetlands can generally be found on the outside of a depression, or on a slope. Playa wetlands are generally found around the Great Salt Lake, and are characterized as depressions with scarce vegetation, no water outlets, and are highly saline (UDOT, 2015c). Vegetation of the wetlands surrounding Great Salt Lake varies, based on the salinity of the water

[67] 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).

(UDEQ, 2009). Based on the USFWS NWI 2014 analysis, PEM is the dominant wetland type (82 percent), followed by PFO/PSS (13 percent), PAB/PUB (ponds) (five percent), and other palustrine wetlands (less than one percent). As shown in Table 16.1.5-2, there are currently about 366,000 acres of palustrine (freshwater) wetlands in the state.

The amount and condition of Utah wetlands continues to decline. This loss is mostly a result of human activities. Development, including businesses, houses, roads, and energy development, damage or destroy wetland habitats. Drought and water demands in the state have also diverted water from native wetlands. Selenium and other pollutants can accumulate in wetlands, and non-native, invasive species, such as tamarisk, outcompete native plants. Finally, improper grazing practices have resulted in both habitat loss and increased water pollution in wetlands. (DWR, 2015)

Lacustrine Wetlands

Lacustrine wetlands are mostly found around the Great Salt Lake as fringe wetlands, or mudflats.

The largest wetland area in the state surrounds the Great Salt Lake, as shown in Figure 16.1.5-2, with wetlands mostly concentrated around the northeastern, eastern and southern shore, where freshwater inputs from the Jordan, Weber, and Bear Rivers occur. Wetland types include emergent marsh, playa (shallow, ephemeral ponds) (see above for discussion), fringe, and artificial impoundments. Wetland acreage around the Great Salt Lake can fluctuate due to the dynamic nature of the lake. The nature of the lake also brings challenges to wetland classification. Water salinity and shoreline sediments are the primary factors that dictate the location, extent, and type of wetlands surrounding the lake; as freshwater inputs and water levels change, so too do the wetlands' nature, location, and acreage. It has been estimated that for every one foot the water level of the lake falls or rises, an approximate 44,000 acres of wetlands can be exposed or flooded (UDEQ, 2009).

Figure 16.1.5-1: Great Salt Lake Wetlands

Source: (DWR, 2015)

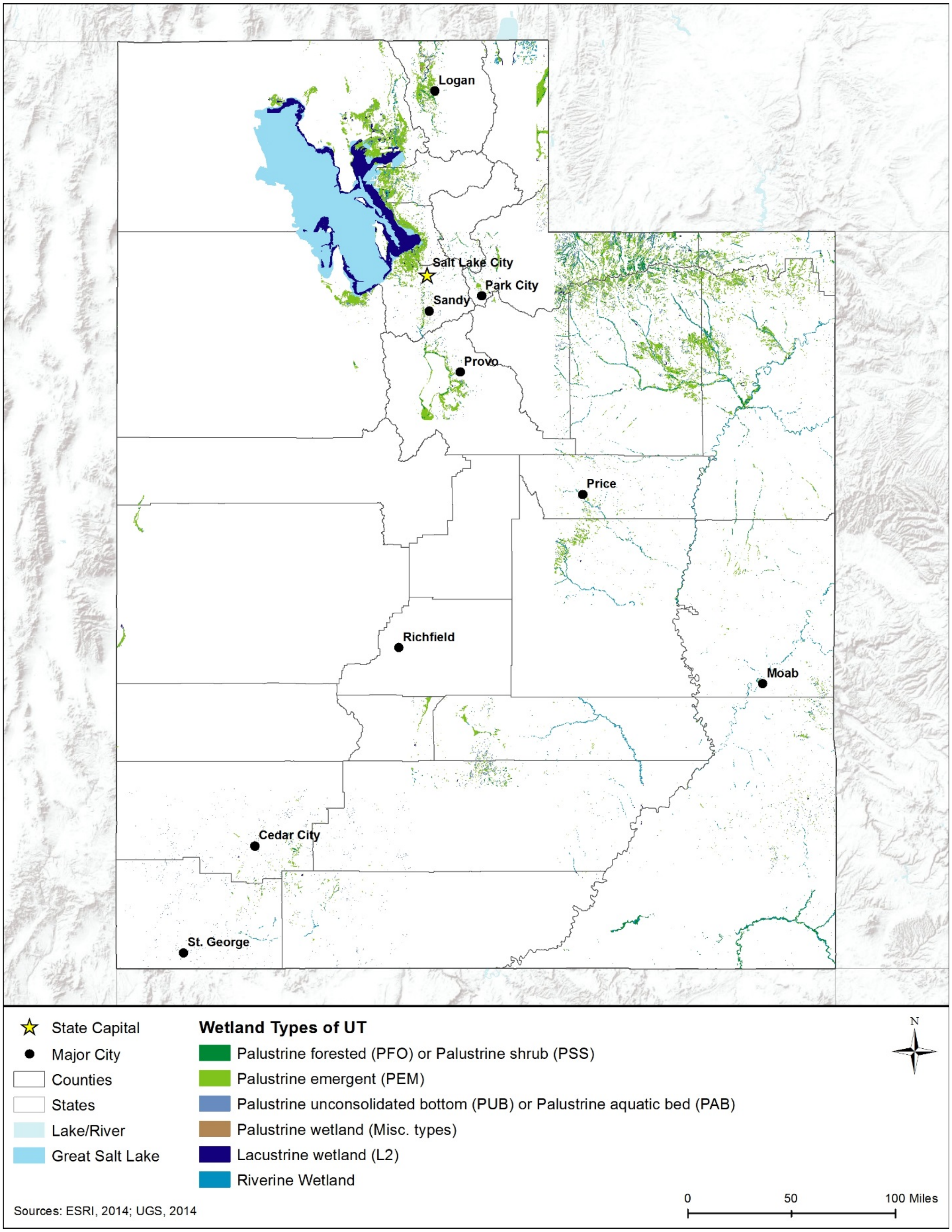


Figure 16.1.5-2: Wetlands by Type, in Utah, 2014

16.1.5.4. *Environmental Setting: Wetlands of Special Concern or Value*

Bogs, Fens, and Peatlands

Wetlands of special value in Utah include bogs, fens, and peatlands. In Utah, areas classified as fens, bogs and peatlands, and locations contiguous with fens, are protected under the USACE Nationwide permit. Fens, or slope wetlands, are hydrologically fed by groundwater, and are typically saturated through the growing season, except during drought conditions when they can become dry (USACE, 2012). Peatlands in Utah include areas with peat (Peteetneet) soil that take many years to form and are quite rare (UDOT, 2007). In addition to protections under the state's regulations and national CWA, Utah considers bogs, fens, and peatlands as wetland communities as areas of special value due to their global or regional scarcity, unusual local importance, or habitat they support.

Other Important Wetlands Sites in Utah

The Utah Division of Wildlife Resources manages waterfowl Management Areas (WMAs) in Utah for habitat and hunting opportunities of waterfowl and other migratory birds. For example, the Farmington Bay Waterfowl Management Area provides habitat for more than 200 species of birds during nesting and migration, and includes more than 18,000 acres of wetlands (Utah Division of Wildlife Resources, 2013). For more information on WMAs, visit: http://wildlife.utah.gov/hunting-in-utah/hunting-information/waterfowl.html

The Utah Lake Wetland Preserve is at the south end of Utah Lake, in the central area of the state. It contains over 21,000 acres of wetlands providing both breeding grounds and habitat for migratory birds (Utah Reclamation Mitigation and Conservation Commission, 2015).

National Natural Landmarks (NNL) are sites designated because they contain the best remaining examples of specific biological and/or geological features. The natural features represented include aquatic and terrestrial ecosystems, geological processes and resultant landforms, and records of geologic history. There are four NNL sites within Utah. The sites range from a few acres to over 31,000 acres, and are owned by the U.S. Forest Service (USFS) and Bureau of Land Management (BLM). Section 16.1.8, Visual Resources, describes Utah's NNLs.

Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state. This includes Natural Resources Conservation Service (NRCS) Agricultural Conservation Easement Program, Farm Service Agency Conservation Reserve Program, and easements managed by natural resource conservation groups such as state land trusts, The Nature Conservancy, 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 more than 2,000 acres in conservation easements in Utah (NCED, 2016).

16.1.6. Biological Resources

16.1.6.1. Definition of the Resource

This section describes the biological resources of Utah. Biological resources include terrestrial[68] vegetation, wildlife, fisheries and aquatic[69] habitats, and threatened[70] and endangered[71] species as well as 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, Utah supports a wide diversity[72] of biological resources ranging from low- and high-mountains in the western section of the state, to the table top plateau region that dominates the eastern Utah. Each of these topics is discussed in more detail below.

16.1.6.2. 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 Utah are summarized in Appendix C, Environmental Laws and Regulations. Table 16.1.6-1 summarizes major state laws relevant to Utah's biological resources.

Table 16.1.6-1: Relevant Utah Biological Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
County Noxious Weed Control Act; Utah Code Title 4, Chapter 17	County Weed Management Districts	Gives authorization to develop, implement, and pursue a program for the control and containment of noxious weeds.
Aquatic Invasive Species Interdiction Act; Utah Code Title 23, Chapter 27	Utah Division of Wildlife Resources (UDWR)	Prohibits the possession, importation, exportation, shipment, or transport of Dreissenid mussels, including the quagga mussel (Dreissena bugensis), zebra mussel (Dreissena polymorpha), and false darkmussel (Mytilopsis leucophaeata); prohibits releasing, placing, planting, or causing to be released, placed, or planted Dreissenid mussels in a waterbody, facility, or water supply system.
Wolf Management Act; Utah Code Title 23, Chapter 29	UDWR	Manages wolves to prevent the establishment of a viable pack in all areas of the state where the wolf is not listed as threatened or endangered under the Endangered Species Act.
Mule Deer Protection Act; Utah Code Title 23, Chapter 30	UDWR	Establishes programs to accomplish targeted or general predator control, including programs that offer incentives or compensation to participants who remove a predatory animal that is detrimental to mule deer production.

[68] Terrestrial: "Pertaining to land" (USEPA, 2015g).
[69] Aquatic: "Pertaining to water" (USEPA, 2015g).
[70] 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)).
[71] 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)).
[72] Diversity: "An ecological measure of the variety of organisms present in a habitat" (USEPA, 2015g).

State Law/Regulation	Regulatory Agency	Applicability
Pelican Management Act; Utah Code Title 23, Chapter 21a	UDWR	Initiates purchase of the 163-acre Gunnison Island and the 22-acre Hat (Bird) Island in the Great Salt Lake; provides protection of the American white pelican.
Collection, Importation and Possession of Amphibians and Reptiles (R657-53-1)	UDWR	Governs the collection, importation, exportation, transportation, and possession of amphibians and reptiles.

16.1.6.3. Terrestrial Vegetation

The distribution of flora within the state is a function of the characteristic geology,[73] soils, climate,[74] and water of a given geographic area and correlates with distinct areas identified as ecoregions.[75] Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions and represent ecosystems contained within a region. The boundaries of an ecoregion are not fixed; they depict a general area with similar ecosystem types, functions, and qualities (National Wildlife Federation, 2015; World Wildlife Fund, 2015; USFS, 2015a).

Ecoregion boundaries often coincide with physiographic[76] regions of a state. In Utah, the three main physiographic regions include the Central Basin Range, the Colorado Plateau, and the Middle Rocky Mountains. These regions are separated by the Wasatch and Uinta Mountains. The ecoregions mapped by the USEPA are the most commonly referenced, although individual states and organizations have also developed 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 Utah at USEPA Level III. (USEPA, 2016a)

As shown in Figure 16.1.6-1, the USEPA divides Utah 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 ranging from the low desert scrub of the Mojave Desert, to the wetlands surrounding the Great Salt Lake, to the alpine tundra and coniferous forests of the Uinta and Wasatch Mountains. Table 16.1.6-2 provides a summary of the general abiotic[77] characteristics, vegetative communities, and the typical vegetation found within each of the seven Utah ecoregions.

[73] 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.

[74] Climate: "The average weather conditions in a particular location or region at a particular time of the year. Climate is usually measured over a period of 30 years or more" (USEPA, 2015g).

[75] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables" (USEPA, 2015g).

[76] Physiographic: "The natural, physical form of the landscape" (USEPA, 2015g).

[77] 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, 2016f).

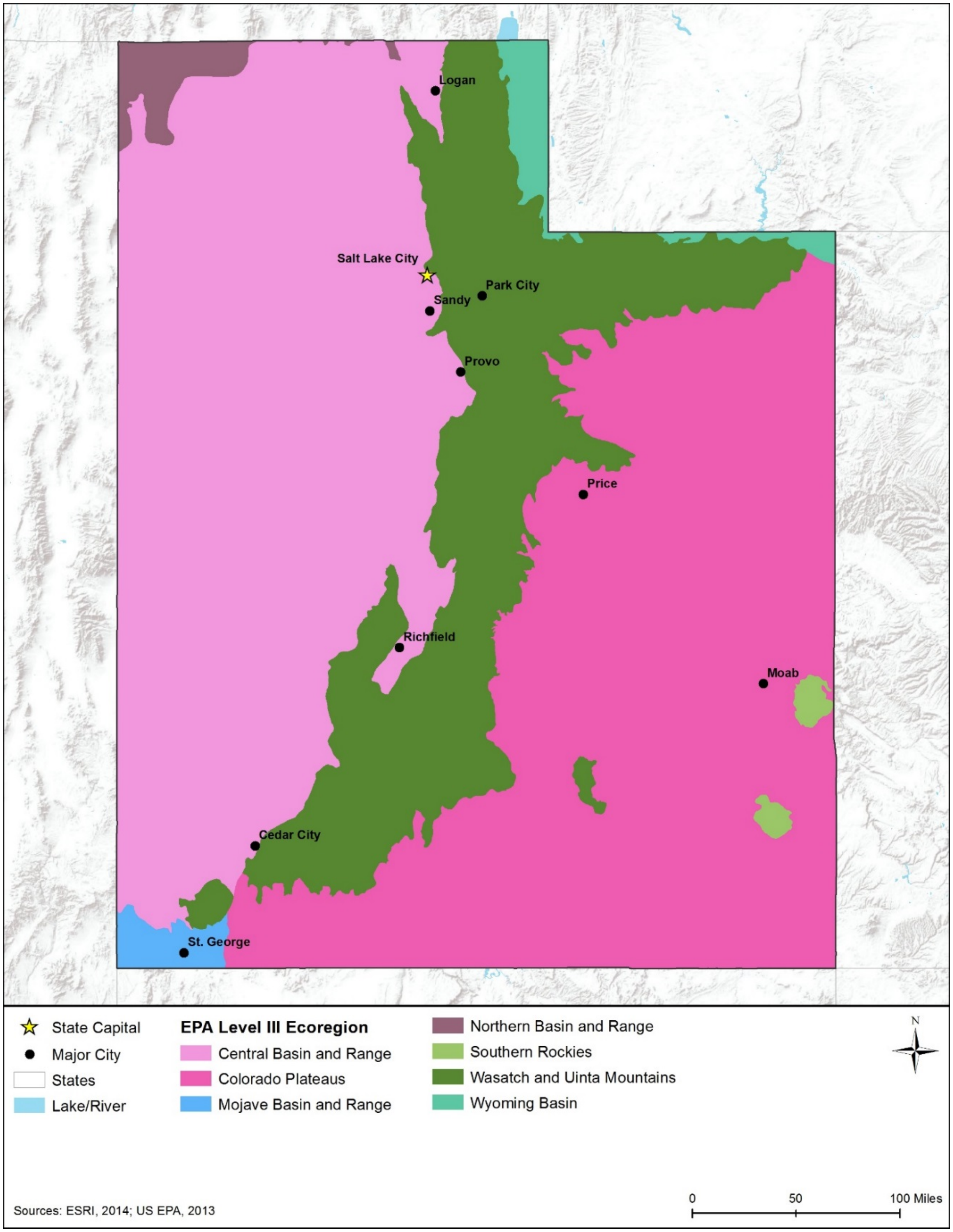


Figure 16.1.6-1: USEPA Level III Ecoregions in Utah

Table 16.1.6-2: USEPA Level III Ecoregions of Utah

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
Geographic Region: Basin and Range				
13	Central Basin Range	Composed of northerly trending, fault-block ranges and intervening, drier basins where valleys, slopes, and alluvial fans are either shrub and grass-covered, shrub-covered, or barren.	Saltbush-Greasewood, Great Basin Sagebrush, Juniper-Pinyon Woodland, Spruce Fir Forest	• **Shrub** - Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), black sagebrush (*Artemisia nova*), mountain big sagebrush (*Artemisia tridentate ssp. vaseyana*)
14	Mojave Basin Range	Made up of basins and scattered mountains that are generally lower, warmer, and drier than those of the Central Basin and Range.	Creosote Bush, Juniper-pinyon woodland	• **Shrub -** Creosote bush (*Larrea tridentata*), Joshua tree (*Yucca brevifolia*), black brush (*Coleogyne ramosissima*), big sage brush (*Artemisia tridentata*)
80	Northern Basin Range	Consists of dissected lava plains, rolling hills, alluvial fans, valleys, and scattered mountains.	Sagebrush Steppe, Juniper Woodlands, Grasses	• **Shrub -** Wyoming big sagebrush, black sagebrush • **Forbs/Grasses -** Bluebunch wheatgrass (*Pseudoroegneria spicata*), and Idaho fescue (*Festuca idahoensis*)
Geographic Region: Colorado Plateau				
18	Wyoming Basin	This area is a broad intermontane basin containing rolling plains, high hills, mesas, and low mountains and dominated by arid grasslands and shrublands.	Douglas fir Forest, and Lodgepole Pine Forest	• **Conifer Trees -** Douglas fir (*Pseudotsuga menziesii*), lodgepole pine (*Pinus contorta*), and western white pine (*Pinus monticola*).
20	Colorado Plateaus	An area of uplifted, eroded, and deeply dissected tableland where benches, mesas, buttes, salt valleys, cliffs, and canyons are formed in and underlain by thick layers of sedimentary rock.	Juniper-pinyon woodland Saltbush-greasewood	• **Hardwood Trees** - Junipers (*Juniperus* spp.), singleleaf ash (*Fraxinus anomala*) • **Conifer Trees** - Pinyon pines (*Pinus edulis* and *Pinus monophylla*), singleleaf ash (*Fraxinus anomala*) • **Shrub** - Utah service berry (*Amelanchier utahensis*)

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
21	Southern Rockies	Made up of isolated, laccolithic78 mountains that protrude from the dry expanses of the Colorado Plateaus where vegetation, soils, and land use are elevationally banded.	Subalpine Forests, Dry Forests Shrublands	• **Conifer Trees** - Pines (*Pinus* spp.), Douglas fir, ponderosa pine (*Pinus ponderosa*)
Geographic Region: Middle Rocky Mountains				
19	Wasatch and Uinta Mountains	Composed of high, glaciated mountains, dissected plateaus, foothills, and intervening valleys, including extensively glaciated Uinta Mountains, the Wasatch Range, and the Wasatch Plateau.	Subalpine Forests, Douglas Fir Forests, Juniper-Pinyon Woodland, Mountain Mahogany Oak Scrub	• **Conifer Trees** - Lodgepole pine (*Pinus contorta*), ponderosa pine, Douglas fir

Sources: (USEPA, 2015l; UDNR, 2015b)

[78] A laccolith is a blister-shaped intrusion. See 'Dome Mountain'. Dome Mountains: Dome Mountains are formed from hot molten material (magma) rising from the Earth's mantle into the crust that pushes overlying sedimentary rock layers upward to form a 'dome' shape. Unlike a volcano, the magma typically does not reach the Earth's surface. Instead, the magma cools underneath the surface and forms the core of the mountains. Dome mountains in Utah include Navajo Mountain, and the La Sal, Abajo, and Henry Mountains in the southeastern part of the state.

Communities of Concern

The UDWR manages the Utah Natural Heritage Program (UNHP) for the state of Utah. The UNHP functions as an ongoing biological survey of the state with an emphasis on rare or declining plant and wildlife species. Many state Natural Heritage Programs (NHPs) use 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, the UNHP does not maintain these rankings for vegetation communities within the state. (UDWR, 2015a)

Nevertheless, the 2005-2015 Utah Comprehensive Wildlife Conservation Strategy has designated 10 vegetative communities (both terrestrial and aquatic)[79] as key habitat types for conservation in the state. The Utah ranking system prioritizes habitat types based on the following.

1. Abundance of the habitat in Utah;
2. Threats to the habit in Utah;
3. Trends of the habitat in Utah;
4. Importance of the habitat to Tier I, II, and III species in Utah; and
5. Importance of the habitat to Utah's overall vertebrate biodiversity.

These habitat types are considered priority habitats because they contain or support greater numbers of species in greatest conservation need, and are large in acreage. As new surveys and studies provide additional data, these ranks are revised as necessary to reflect the current state of the community (UDWR, 2015a). Utah Appendix A, Table A-1 summarizes the seven key terrestrial habitat types found in Utah.

Nuisance and Invasive[80] Plants

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

Noxious weeds are typically non-native species that have been introduced into an ecosystem inadvertently; however, on occasion native species can be considered a noxious weed. Noxious weeds greatly affect agricultural areas, forest management, natural, and other open areas (Government Printing Office, 2011).

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[79] The Utah Comprehensive Wildlife Conservation Strategy identifies ten key habitats: Lowland Riparian Habitat, Wetlands, Mountain Riparian Habitat, Shrubsteppe, Mountain Shrub Habitat, Flowing-Water Habitat, Wet Meadows, Grasslands, Standing-Water Habitat, Aspen Forest.

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

The U.S. government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S.C. 7701 *et seq.*). As of September 2014, 112 federally recognized noxious weed species have been catalogued in the U.S., 88 of which are terrestrial, 19 aquatic, and 5 parasitic (USDA, 2014).

Within the state of Utah, a noxious weed is "any plant the commissioner determines to be especially injurious to public health, crops, livestock, land, or other property." The Utah Noxious Weed Control Act (Title 4, Chapter 17) stipulates that the commissioner be responsible for the establishment of the statewide noxious weed list and updates to that list, as necessary. In addition, the Act further stipulates that each county is responsible for implementing and enforcing noxious weed management. Further, individual counties in Utah may also develop a list of noxious weeds to be regulated at the county level. As of 2010, a total of 28 state-listed noxious weeds/complexes and plants are regulated in Utah, with additional plants proposed in February, 2015 (Utah Commissioner of Agriculture and Food, 2010) (Utah Department of Agriculture, 2015). None of these species occur on the Federal Noxious Weed List (USDA 2014). These species/complexes are designated into one of the following three classes: Class A (Early Detection Rapid Response (EDRR); Class B (Control); and Class C (Containment) (Utah Commissioner of Agriculture and Food, 2010). The following species by Class type are regulated in Utah.

- **Class A (EDRR) –** black henbane (*Hyoscyamus niger*), diffuse knapweed (*Centaurea diffusa*), leafy spurge (*Euphorbia esula*), medusahead (*Taeniatherum caput-medusae*), ox-eye daisy (*Chrysanthemum leucanthemum*), johnsongrass (*Sorghum halepense*), sorghum almum (*Sorghum almum*), purple loosestrife (*Lythrum salicaria*), spotted knapweed (*Centaurea maculosa*), squarrose knapweed (*Centaurea squarrosa*), St. Johnswort (*Hypericum perforatum*), sulfur cinquefoil (*Potentilla recta*), yellow starthistle (*Centaurea solsitialis*), and yellow toadflax (*Linaria vulgaris*)
- **Class B (Control) –** bermudagrass (*Cynodo dactylon*), broad-leaved peppergrass (*Lepidium latifolium*), dalmatian toadflax (*Linaria dalmatic*), dyers woad (*Isatis tinctoria*), hoary cress (*Cardaria* spp.), musk thistle (*Carduus nutans*), poison hemlock (*Conium maculatum*), Russian knapweed (*Centaurea repens*), and scotch thistle (*Onopordium acanthium*)
- **Class C (Containment) –** field bindweed (*Convolvulus* spp.), Canada thistle (*Cirsium arvense*), houndstounge (*Cynoglossum officianale*), saltcedar (*Tamarix ramosissima*), and quackgrass (*Agropyron repens*)

16.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Utah, divided among mammals,[81] birds,[82] reptiles and amphibians,[83] and invertebrates.[84] Terrestrial wildlife consists of those species, and their habitats, that live predominantly on land. Terrestrial wildlife includes common big game species, small game animals, furbearers,[85] nongame animals, game birds, waterfowl, and migratory birds as well as their habitats within Utah. A discussion of non-native and/or invasive terrestrial wildlife species is also included within this section. Information regarding the types and location of native and non-native/invasive wildlife is useful for assessing the importance of any impacts to these resources or the habitats they occupy. According to UDWR, the state is home to 134 mammal species, 83 fish species, 57 reptile species, more than 10,000 invertebrate species, 17 amphibian species, 335 resident bird species, and 100 migratory bird species (UDWR, 2015a).

Mammals

Common and widespread mammalian species in Utah include the mule deer (*Odocoileus hemionus*), badger (*Taxidea taxus*), and black-tailed jackrabbit (*Lepus californicus*). Most mammals are widely distributed; however, there are some species, such as elk (*Cervus canadensis*) and black bear (*Ursus americanus*) that are found primarily in the higher elevations within the state. A number of threatened and endangered mammals are located in Utah. Section 16.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

In Utah, mule deer, elk, moose (*Alces alces*), pronghorn (*Antilocapra americana*), big horn sheep (*Ovis canadensis*), mountain goat (*Oreamnos americanus*), mountain lion (*Puma concolor*), bison (*Bison bison*), and black bear are classified as big game species, whereas small game species include small mammals (e.g., squirrels and rabbits), furbearers, and upland and migratory game birds (UDWR, 2015a). The following eight species of furbearers may be legally hunted or trapped in the Utah: beaver (*Castor canadensis*), badger (*Taxidea taxus*), red fox (*Vulpes vulpes*), grey fox (*Urocyon cinereoargenteus*), kit fox (*Vulpes macrotis*), ringtail (*Bassariscus astutus*), stripped skunk (*Mephitis mephitis*), spotted skunk (*Spilogale spp*.), weasel (*Mustela* spp.), muskrat (*Ondatra zibethicus*), mink (*Neovison vison*), marten (*Martes spp*.) and bobcat (*Lynx rufus*) (UDNR, 2015c).

Utah has identified 26 mammals as Species of Greatest Conservation Need (SGCN). The SGCN list consists of at-risk species that are rare or declining. State Wildlife Grants can provide funding for efforts to reduce their potential to be listed as endangered. Although these species

[81] 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, 2015g).

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

[83] 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, 2015g).

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

[85] Furbearers: "Mammals that are traditionally been hunted and trapped for their fur."

have been targeted for conservation, they are not currently warranted legal protection (e.g., via the Endangered Species Act [ESA]). The SGCN list is updated periodically and is used by the state of Utah to focus their conservation efforts and as a basis for implementing their Utah Comprehensive Wildlife Conservation Strategy (UDWR, 2015a).

Birds

The number of native bird species documented in Utah varies according to the timing of the data collection effort, changes in bird taxonomy[86], and the reporting organization's method for categorizing occurrence and determining native versus non-native status. Further, the diverse ecological communities (i.e., mountains, lakes, plains, etc.) found in Utah support a large variety of bird species.

As of 2015, 435 species of resident and migratory birds have been documented in Utah, which includes 26 identified SGCN (UDWR, 2015a).

Both the Central and Pacific Flyways pass over Utah. Covering the eastern region of Utah, the Central Flyway spans from the Gulf Coast of Texas to the Canadian boreal forest. The Pacific Flyway covers the remainder of the state and spans from the west coast of Mexico to the Arctic. Large numbers of migratory birds utilize these flyways and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall. The Migratory Bird Treaty Act (MBTA) makes it "illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations" (USFWS, 2013a). The USFWS is responsible for enforcing the MBTA and maintaining the list of species protected under the Act. 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 year-round near large rivers and lakes throughout the state (eBird, 2015a). Golden eagles are generally found in a variety of habitats within their known range, but they generally nest in mountains and cliffs. Golden eagles are also found throughout the state all year (eBird, 2015b).

As shown in Figure 16.1.6-2, 22 Important Bird Areas (IBAs) have also been identified in Utah. The IBA program is an international bird conservation initiative with a goal of identifying the most important places for birds, and conserving 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. 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 to be important for globally rare species or

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

to support bird populations at a global scale. Continental IBAs are sites determined to be important for continentally rare species or to support bird populations at a continental scale, but do not meet the criteria for a global IBA. State IBAs are sites determined to be important for state rare species or to support local populations of birds.

According to the National Audubon Society, as of 2013, a total of 22 IBAs have been identified in Utah, including breeding range[87], migratory stop-over, feeding, and over-wintering areas, and include a variety of habitats such as native grasslands, grasslands, sage brush, and wetland/ riparian[88] areas (The Audubon Society, 2015). These IBAs are distributed throughout the state, although the largest concentration of IBAs are located in the Canyonlands area in the Colorado Plateau in the southeast region of the state and the Great Salt Lake area in the Basin and Range area in the northwest region of the state. Other IBAs such as Upper Strawberry Watershed, located in central region of the state, are important migration stops and breeding grounds for many waterfowl species. Four threatened and endangered birds are found in Utah. Section 16.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

Reptiles and Amphibians

A total of 71 native reptile and amphibian species occur in the state of Utah including 17 frogs and toads, three turtles, 21 lizards, and 30 snakes (UDWR, 2015b; UDWR, 2015c). These species occur in a wide variety of habitats from the basin ranges in the west to Colorado Plateau and Middle Rocky Mountains, with very few species being widespread throughout the state. For example, within Utah, the spiny softshell turtle (*Apalone spinifera*) has habitat limited to the Virgin River Valley in the southwestern corner of the state (USGS, 2015j). Of the 71 native reptile and amphibian species, 20 SGCN have been identified (UDWR, 2015a).

Utah's reptile and amphibian species are covered under Utah Administrative Code R-657-53, Amphibian and Reptile Collection, Importation, Transportation and Possession (Utah Department of Administrative Services, 2015).

[87] Breeding range: "The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared" (USEPA, 2015g).
[88] 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, 2015g).

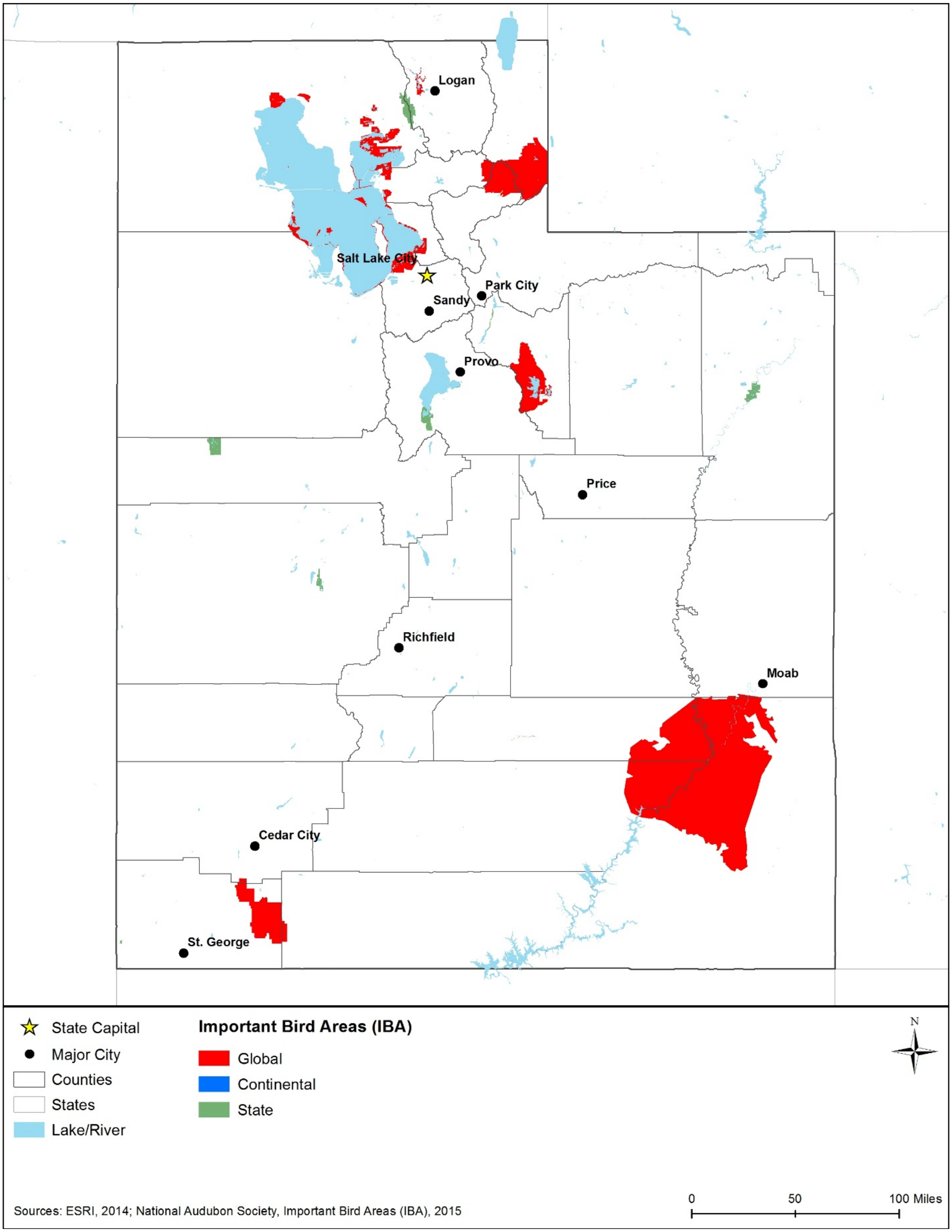

Figure 16.1.6-2: Important Bird Areas of Utah

Invertebrates

Utah is home to more than 10,000 species of invertebrates, including a wide variety of bees, hornets, wasps, butterflies, moths, beetles, flies, dragonflies, damselflies, spiders, mites, and nematodes (UDWR, 2015a). These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. In the U.S., one-third of all agricultural output depends on pollinators.[89] 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" (USDA, 2005). Utah is home to more than 20 percent of the 4,000 native bees of North America, including 900 species native to the state (Utah State University Extension, 2013). The number of butterfly and skipper species that occur in the state is unknown, but species from 8 families (more than 250 known species) have been recorded (Utah Lepidopterists' Society, 2007).

Invasive Wildlife Species

Utah has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select wildlife species (e.g., Aquatic Invasive Species Interdiction Act [Chapter 27]). The Natural Resources Conservation Service, Utah (NRCS UT) also maintains a list of non-native species that could pose a risk to cropland, rangeland, or wildlands; this list includes an amphibian species, five invertebrates, and five mammal species. In addition, the list includes all non-native agricultural pests, all non-native, non-sport fish, and sport fish in sensitive, non-game areas (NRCS, 2011). 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.

16.1.6.5. Fisheries and Aquatic Habitat

This section discusses the aquatic wildlife species in Utah, including freshwater fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented. No essential fish habitat (EFH) identified by the Magnuson-Stevens Fishery Conservation and Management Act exists in Utah. Critical habitat for threatened and endangered fish species, as defined by the ESA, does exist within Utah and is discussed in Section 16.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Freshwater Fish

Utah is home to breeding populations of more than 83 species of freshwater fish, ranging in size from minnows to larger species such as the land-locked sockeye (or kokanee) salmon. These species are grouped into 15 families, as follows: bullheads/catfishes, burbot, killfishes,

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

livebearers (i.e., mosquito fish, mollies, and sword tails), minnows, perches, pikes/pickerels, sculpins, sticklebacks, suckers, sunfishes, temperate basses, trout, and trout-perch. A brief description of those families that contain common species, notable sport fish species, or species of concern is provided below (UDWR, 2015d).

The bullheads/catfishes family includes four species, which include the channel catfish (*Ictalurus punctatus*), stone cat (*Noturus flavus*), yellow bullhead (*Ameiurus natalis*), and black bullhead (*Ameiurus melas*). The channel catfish prefers warmer waters such as Utah Lake and is located throughout the state. It is also a widely recognized game fish and avidly sought after by Utah sport fishermen (UDWR, 2015e). The yellow bullhead and black bullhead are smaller members of the catfish family that rarely reach an adequate size to be targeted by fisherman.

The burbot (*Lota lota*) is the only species in the burbot family found in Utah. This fish was illegally introduced in Wyoming above the Flaming Gorge Reservoir and is now only found in Utah within this reservoir (UDWR, 2015f).

Approximately 12 species of minnows occur in Utah, five of which are introduced (i.e., non-native) species. Common minnow (*Phoxinus phoxinus*) species in Utah include the fathead minnow (*Pimephales promelas*), emerald shiner (*Notropis atherinoides*), and longnose dace (*Rhinichthys cataractae*). This family contains four SGCN: the least chub (*Iotichthys phlegethontis*), northern leatherside chub (*Lepidomeda copei*), virgin spinedace (*Lepidomeda mollispinus*), and woundfin (*Plagopterus argentissimus*) (UDWR, 2015a). Minnows are not typically a popular sportfish, but are a commercially important fish and an important prey source for larger fish and other wildlife (UDWR, 2015a).

Four perch species occur in Utah, including large species such as walleye (*Sander vitreus*) and yellow perch (*Perca flavescens*). Walleye are non-native to Utah but have become established in many areas, including Utah Lake, Yuba Lake, Starvation Reservoir, Deer Creek Reservoir, and Willard Bay Reservoir. Preferring large lakes or streams, walleye are often found near the bottom in beds of aquatic vegetation (UDWR, 2015g). The yellow perch (non-native) is commonly found throughout Utah. Yellow perch populations grow quickly; the fish will often stunt, or remain small throughout life, due to over-crowding unless a significant number of perch are removed from the system through predation or angling (UDWR, 2015h).

Two species of pikes/pickerels occur in Utah's waters, the northern pike (*Esox lucius*) and the tiger muskie (*Esox lucius X E. masquinongy*). The northern pike has a larger distribution throughout Utah compared to the tiger muskie, which is a sterile hybrid between a northern pike and a muskellunge (UDWR, 2015i; UDWR, 2015j). Both species are found in bays of lakes and reservoirs with dense weed growth. The northern pike's voracious predatory nature has made it an excellent sport fish throughout Utah.

The suckerfish family includes eight species in Utah. Common and widespread species include the Utah sucker (*Catostomus ardens*), the mountain sucker (*Catostomus platyrhynchus*), and the white sucker (*Catostomus commersonii*) (UDWR, 2015d). There are five sucker SCGN in Utah: bluehead sucker (*Catostomus discobolus yarrowi*), desert sucker (*Catostomus clarki*), flannelmouth sucker (*Catostomus latipinnis*), June sucker (*Chasmistes liorus*), and razorback sucker (*Xyrauchen texanus*) (UDWR, 2015a). Both the June and razorback suckerfish are federally listed as endangered (UDWR, 2015a).

The sunfish family includes eight species, many of which are highly popular with sport fishermen. The most commonly encountered species are bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), white crappie (*Pomoxis annularis*), largemouth bass (*Micropterus salmoides*), and smallmouth bass (*Micropterus dolomieu*). These species live in a wide variety of habitats, including rocky, cool lakes, streams, and reservoirs (UDWR, 2015d).

Utah is home to 12 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 Utah. They occupy the cold water streams and lakes throughout the state (UDWR, 2015k; UDWR, 2015l; UDWR, 2015m). The trout family also contains three SGCN: the Bonneville cutthroat trout (*Oncorhynchus clarki utah*), Colorado River cutthroat trout (*O. clarki pleuriticus*), and Yellowstone cutthroat trout (*O. clarkii bouvieri*) (UDWR, 2015a).

The trout-perch (*Percopsis omiscomaycus*) is the only Utah species in the *Percopsidae* family and displays traits of both trout and perch families. Different from most other fish species, the trout-perch has spiny fin rays, like a perch, but also has an adipose fin (a small fleshy fin behind the dorsal fin), like a trout. While non-native to Utah (trout-perch is native to the Columbia River system) this species has been introduced to Willard Bay Reservoir (UDWR, 2015n).

Shellfish and Other Invertebrates

Utah is home to 69 mollusk species, including six freshwater bivalve[90] species (Oliver, 1999). Two of the freshwater bivalve species, the California floater (*Anodonta californiensis*) and western pearlshell (*Margaritifera falcata*), are SGCN (UDWR, 2015a). The western pearlshell inhabits the coldwater trout streams in Utah while the California floater is found in slow-moving streams, lakes, and reservoirs. River diversions and impoundments are a primary threat to these species. Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), other well-known Utah freshwater invertebrates include a variety of crayfish, fairy shrimp, amphipods, and pill bug species (UDWR, 2015a).

Invasive Aquatic Species

As previously discussed, Utah has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase and introduction of select invasive species, both plants and animals. UDWR maintains a list of prohibited species and controlled species. These lists are presented in the Utah Aquatic Invasive Species Management Plan and governed by UTAC R-657-60 and UC Title 27, Chapter 27, respectively. Currently, the list of prohibited aquatic species includes only Dreissena mussels (*Dreissena* spp.). However, the New Zealand mudsnail (*Potamopyrgus antipodarum*), Eurasian watermilfoil (*Myriophyllum spicatum*), and Quagga

[90] Bivalves: "A mollusk with a soft body enclosed by two distinct shells that are hinged and capable of opening and closing" (Smithsonian Institution, 2016).

(*Dreissena bugensis*) and Zebra mussels (*Dreissena polymorpha*) are considered nuisance aquatic species within the state (UDWR, 2013).

16.1.6.6. Threatened and Endangered Species and Species of Conservation Concern

The USFWS is responsible for administering the ESA (16 U.S.C. §1531 et seq.) in Utah. The USFWS has identified 21 federally endangered and 21 federally threatened species known to occur in Utah (USFWS, 2015ah). Of these 42 federally listed species, 17 of them also have designated critical habitat[91] in the state (Figure 16.1.6-3) (USFWS, 2016a). Three candidate species[92] are identified by USFWS as occurring within the state (USFWS, 2015c). Candidate species are not afforded statutory protection under the ESA. However, the USFWS recommends taking these species into consideration during environmental planning and impact assessment because they could be listed in the future (USFWS, 2014a). The 42 species include 2 mammals, 4 birds, 1 reptile, 9 fish, 1 invertebrate, and 25 plants (USFWS, 2015ah), 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.

Mammals

Two threatened mammals are federally listed for Utah, as summarized in Table 16.1.6-3. The Canada lynx (*Lynx canadensis*) is found in northeastern Utah, and the Utah prairie dog (*Cynomys parvidens)* is found in southwestern Utah. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Utah is provided below. There is a population of the endangered black-footed ferret (*Mustela nigripes*) in eastern Utah; however, it has been classified as experimental/non-essential by USFWS and will not be discussed in this section (USFWS, 2015d).

Table 16.1.6-3: Federally Listed Mammal Species of Utah

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Utah	Habitat Description
Canada Lynx	*Lynx canadensis*	T	No	Found in spruce/fir forests in northeastern Utah.
Utah Prairie Dog	*Cynomys parvidens*	T	No	Found in moist, herbaceous vegetation with well-drained soils in southwestern Utah.

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

[91] 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)).
[92] 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, 2014n).


Canada lynx Photo Credit: USFWS

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 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 Canada lynx populations (USFWS, 2005; USFWS, 2013i). This species was federally listed as threatened in 2000 (65 FR 16053 16086, March 24, 2000). In Utah, it is found in 11 counties in the northeastern portion of the state (USFWS, 2015e).

The Canada lynx was listed in 2000 primarily due to concerns with regard to habitat destruction and the need for more regulatory control and consistent guidance for forest management activities. This species travels back and forth between the U.S. and Canada, so contiguous habitat is important. In addition, snowshoe hare habitat is also important because of the direct link between snowshoe hare abundance and lynx abundance and survival. Incidental take of lynx from hunting or trapping is not indicated as a cause for low species densities, according to available data (USFWS, 2005; USFWS, 2013i).

Utah Prairie Dog. The Utah prairie dog is a cinnamon to dark buffy cinnamon color, mixed with small amounts of buff or blackish hairs. The Utah prairie dog is the smallest species of prairie dogs and ranges from 9.8 to 15.7 inches in length and weighs between 1.4 to 3.1 pounds. This species was federally listed as endangered in 1973 (38 FR 14678, June 4, 1973). In 1984, the species was reclassified as threatened (49 FR 22330 22334, May 29, 1984). In Utah, it is found in seven counties in the southwestern portion of the state (USFWS, 2015f).

Suitable habitat for the Utah prairie dog consists of moist, herbaceous vegetation with well-drained soils. Well-drained soils are essential for burrowing and protection and open habitats are important for foraging, visual surveillance, and intraspecific interactions. The primary causes for this species' near extinction is loss of habitat, plague, climate change and unauthorized take (USFWS, 2012a).

Birds

One federally listed endangered and three federally listed threatened bird species occur in Utah, as summarized in Table 16.1.6-4. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Utah is provided below.

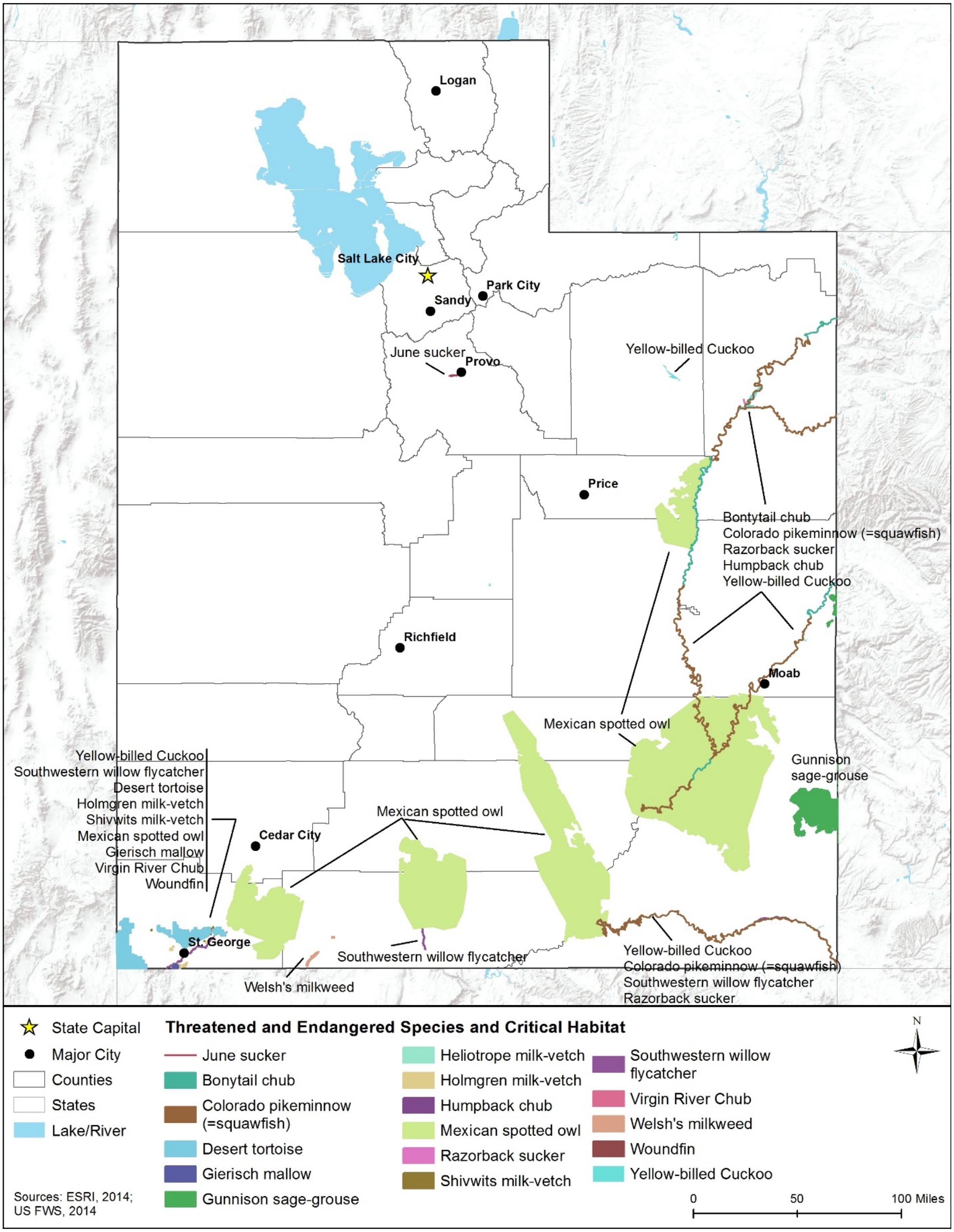

Figure 16.1.6-3: ESA Designated Critical Habitat for the State of Utah

Table 16.1.6-4: Federally Listed Bird Species of Utah

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Utah	Habitat Description
Gunnison Sage-grouse	*Centrocercus minimus*	T	Yes; in Grand and San Juan Counties, Utah.	Occurs in sagebrush and sage-brush grasslands in southeastern Utah.
Mexican Spotted Owl	*Strix occidentalis lucida*	T	Yes; in Carbon, Emery, Garfield, Grand, Iron, Kane, San Juan, Washington, and Wayne Counties, Utah.	Occurs in canyonlands in the western and southwestern portions of Utah.
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E	Yes; in Kane, San Juan, and Washington Counties, Utah.	Occurs in riparian and shrub communities in southern Utah.
Western Yellow-billed Cuckoo	*Coccyzus americanus*	T	Yes; in Uintah, Duchesne, Grand, San Juan, Wayne and Washington Counties, Utah.	Occurs in riparian, forested habitat in the eastern portion of Utah.

Source: (USFWS, 2015ah)

[a] E = Endangered, T = Threatened

Gunnison Sage-grouse. The Gunnison sage-grouse is a large bird that is commonly identified by its dark brown color, distinctive black belly and long, pointed tails. The Gunnison sage-grouse is similar to the Greater sage-grouse; however, in 2000 they were officially recognized as two different species due to geographical isolation and differences in behavioral, genetic and physical characteristics (USFWS, 2013d). Similar to the Greater sage-grouse, this bird also prefers sagebrush habitat. Limited to seven population areas, the current range of Gunnison sage-grouse is located in southwestern Colorado and southeastern Utah. This species was federally listed as threatened in 2014 (79 FR 69191 69310, November 20, 2014) and was designated with critical habitat (79 FR 69311 69363, November 20, 2014) in the Grand and San Juan Counties in Utah (USFWS, 2014b).

The principal threats to Gunnison sage-grouse are habitat loss, degradation, and fragmentation due primarily to residential, exurban, and commercial development and associated infrastructure such as roads and power lines. The declining abundance and quality of sagebrush habitat is the primary threat to this species. While sagebrush is one of the most common vegetation types in the western U.S., nearly all of it has been altered or disturbed in some way due to habitat conversion for agricultural use or urbanization, wildfire, and invasive species encroachment and treatment. Habitat degradation is further exacerbated by the fact it can take “up to 80 years” after impacts occur for sagebrush habitat to recover (USFWS, 2006a; USFWS, 2014b).

Mexican Spotted Owl. The Mexican spotted owl is characterized by its chestnut brown color, white and brown-spotted abdomen and uncommon dark eyes. This owl species has a brown tail with thin white bands and lacks ear tufts (USFWS, 2015g). This species was federally listed as threatened in 1993 and in 2004, the species was designated with critical habitat along the southwestern portion of the state in Carbon, Duchesne, Emery, Garfield, Grand, Iron, Kane, San Juan, Uinta, Washington, and Wayne counties (69 FR 53182 53298, August 31,2004).

The Mexican spotted owl lives in forested mountains and canyonlands throughout the southwestern portion of the state. In Utah, this species is typically found in rocky-canyon habitats. This species uses a diverse array of habitats for foraging and roosting and some undergo altitudinal migration during winter for nesting (USFWS, 2012b). The two primary threats for this species include the alteration of habitat due to timber harvesting and stand-replacing wildland fire (USFWS, 2012b).

Southwestern Willow Flycatcher. The Southwestern Willow flycatcher is a small grey-brown bird with a relatively large bill, white throat and a yellowish belly. This bird species is typically 6 inches in length (including tail) and is characterized by its sharp whistled vocalizations (USFWS, 2015h). This species was federally listed as endangered in 1995 (60 FR 10695 10715, February 27, 1995) and in 2013 it was designated with critical habitat in the southern portion of the state including Kane, San Juan, and Washington Counties (78 FR 343 534, January 3, 2013). Historically, this species was known to occur in the southern portion of the state including the Colorado, Kanab Creek and San Juan River systems.

The southwestern willow flycatcher breeds in relatively dense riparian tree and shrub communities associated with rivers, lakes, swamps and other wetlands. Threats to the species include destruction, thinning or alteration of riparian vegetation and brood parasitism from brown-headed cowbirds. Destruction of riparian vegetation is primarily caused by the reduction or elimination of surface water due to groundwater pumping, livestock grazing, clearing vegetation and the establishment of invasive non-native plants (USFWS, 2002a).

Yellow-billed Cuckoo (Western). The yellow-billed cuckoo is approximately 12 inches in length and weighs approximately two ounces. The western distinct population segment (DPS) is a shy, migrant bird that winters in South America and breeds in the western U.S. The western DPS was federally listed as threatened in 2014 (79 FR 59991 60038, October 3, 2014). Although it is known or believed to occur in all 29 counties in the state, designated critical habitat for this species in Utah includes areas within Uintah, Duchesne, Grand, San Juan, Wayne and Washington counties (79 FR 71373 71375, December 2, 2014) (USFWS, 2015i).

Yellow-billed Cuckoo Photo Credit: USFWS

Currently, the western yellow-billed cuckoo is known to breed in Arizona, California, Colorado, Idaho, New Mexico, Nevada, and Utah (Johnson, Matthew J., 2009). Preferred habitat consists of continuous riparian habitat of cottonwood and willow trees. The yellow-billed cuckoo breeds in forested areas with significant canopy cover. Loss of suitable forested habitat along streams and rivers due to habitat fragmentation, invasion of invasive species, and conversion of land to other uses are considered the primary threats to this species (Johnson, Matthew J., 2009; USFWS, 2015i).

Reptiles

One threatened reptile is federally listed for Utah as summarized in Table 16.1.6-5. The desert tortoise (*Gopherus agassizii*) is found along the lower southwestern portion of the state. Information on the habitat, distribution, and threats to the survival and recovery of this species in Utah is provided below.

Table 16.1.6-5: Federally Listed Reptile Species of Utah

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Utah	Habitat Description
Desert Tortoise	*Gopherus agassizii*	T	Yes; in the Mojave Desert region including Washington County, Utah.	Occurs in a variety of habitats from flats and slopes typically characterized by creosote bush scrub in the lower southwestern portion of Utah.

Source: (USFWS, 2015ah)
T = Threatened

Desert Tortoise. The desert tortoise has a domed shell with yellowish scute centers that have grooved, concentric rings. This species has round, stumpy hind legs and flattened front limbs for digging. The desert tortoise has a small, rounded head, small greenish-yellow eyes and a small tail. Mature adults typically weigh between 8-15 pounds and are approximately 4-6 inches in height (USFWS, 2014c). This species was federally listed as threatened in 1980 (45 FR 55654 55666, August 20, 1980) and in 1994, the desert tortoise was designated with critical habitat (59 FR 5820 5866, February 8, 1994) within the Mojave Desert region including Washington County, Utah.

Desert Tortoise Photo Credit: USFWS

The desert tortoise spends the majority of its life underground and prefers to live in a variety of desert habitats that range from sandy flats to rocky foothills and alluvial fans where suitable soils for digging can be found. In Utah, a population of this species can be found on the Beaver Dam Slope. This species depends on bushes and shrubs for shade and protection from predators, such as coyotes. Primary threats to this species include habitat loss, degradation, and fragmentation (USFWS, 2014c).

Fish

Seven endangered and two threatened fish species are federally listed for Utah, as summarized in Table 16.1.6-6. The razorback sucker (*Xyrauchen texanus*) occurs in the Colorado River Basin. The humpback chub (*Gila cypha*) occurs in the Colorado, Little Colorado, Green, and Yampa rivers. The Colorado pikeminnow (*Ptychocheilus lucius*) occurs in the Colorado, Green, and San Juan rivers. The bonytail chub (*Gila elegans*) occurs in the Colorado and Green rivers and Lake Mohave. The Virgin River Chub (*Gila seminuda (=robusta)*) and the woundfin (*Plagopterus* *argentissimus*) occur in the Virgin River. The June Sucker (*Chasmistes liorus*) occurs in Utah Lake. The Lahontan Cutthroat Trout (*Oncorhynchus clarkii henshawi*) occurs in the Lahontan Basin. The greenback cutthroat trout (*Oncorhynchus clarki stomias*) occurs in streams and lakes in San Juan County, in the southeastern corner of Utah. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Utah is provided below.

Table 16.1.6-6: Federally Listed Fish Species of Utah

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Utah	Habitat Description
Bonytail Chub	*Gila elegans*	E	Yes; in the Green and Colorado Rivers in Uintah, Grand, Garfield, and San Juan counties, Utah.	Occurs in river channels and flooded, ponded, or inundated river eddies and pools. Found in the upper Colorado and Green Rivers and Lake Mohave in 16 counties in Utah.
Colorado Pikeminnow (Squawfish)	*Ptychocheilus lucius*	E	Yes; along the Green, Colorado, and Yampa rivers in Uintah, Carbon, Grand, Emery, Wayne, and San Juan Counties, Utah.	Occurs only in portions of the Green River, upper Colorado River, and a small numbers of individuals in the San Juan River, Utah.
Greenback Cutthroat Trout	*Oncorhynchus clarki stomias*	T	No	Occurs in cold water streams and lakes with adequate spawning habitat. Found in San Juan County, in the southeastern corner of Utah.
Humpback Chub	*Gila cypha*	E	Yes; along the Green and Colorado Rivers in Uintah, Grand, Garfield, and San Juan Counties, Utah.	Occurs in the Colorado, Little Colorado, Green, and Yampa rivers. Found in 16 counties in Utah.
June Sucker	*Chasmistes liorus*	E	Yes; from Utah Lake to the Provo River in Utah.	Occurs only in Utah Lake, Utah.
Lahontan Cutthroat Trout	*Oncorhynchus clarkii henshawi*	T	No	Occurs in cool flowing water within the Lahontan Basin in Utah.
Razorback Sucker	*Xyrauchen texanus*	E	Yes; Utah in the Green, White, Colorado, and Duchesne rivers in Uintah, Carbon, Garfield, Grand, Emery, Wayne, and San Juan Counties, Utah.	Occurs in warm-water reaches of larger rivers of the Colorado River Basin in Utah.
Virgin River Chub	*Gila seminuda*	E	Yes; portions of the Virgin River in Washington County, Utah.	Occurs only in the Virgin River located in Washington County, Utah.
Woundfin	*Plagopterus argentissimus*	E	Yes; along portions of the main stem of the Virgin River and its associated 100-year floodplain, Utah.	Occurs in warm, quiet water habitats with sand substrates within the mainstem of the Virgin River in Utah.

Source: (USFWS, 2015ah)

[a] E = Endangered, T = Threatened

Bonytail Chub. The bonytail chub is an extremely rare, long lived fish, once prevalent in the Colorado River basin. The species has a streamlined body, concave skull, and is pencil-like in appearance, growing over two feet in length. The species was federally listed as endangered in 1980, (45 FR 27710 27713, April 23, 1980) and in Utah has critical habitat designated in the

Green and Colorado River in Uintah, Grand, Garfield, and San Juan counties (59 FR 13374 13400, March 21, 1994). In Utah, it can be found in 16 counties throughout the state (USFWS, 2015k). The bonytail chub is the rarest native fish in the Colorado River Basin and has not been observed infrequently in the last decades. Historically, the fish's range was widespread and abundant throughout the Colorado River Basin in the warmer waters from Mexico to Wyoming. Today, few populations are known to exist in the upper Colorado and Green Rivers and Lake Mohave (USFWS, 2002b).

Though little is known about this rare fish, drawing upon other similar chub, it is speculated that spawning occurs in eddies during the months of June and July and that habitats required for conservation include river channels, and flooded, ponded, or inundated river eddies and pools. Threats to the species include impacts to river hydrology which modify water temperatures, flow rates, and sedimentation of the species habitat. Since 1905, in the lower Colorado River Basin there have been more than 14 dams which impede migration, and make the gene pool less diverse, and have introduced non-native competition from other species. Additional threats include pesticides and pollutants, disease and predation (USFWS, 2002b).

Colorado Pikeminnow (Squawfish). The Colorado pikeminnow, also known as the Colorado squawfish, is the largest American minnow reaching up to 6 feet in length and weighing more than 80 pounds. The speckled greenish fish has an elongated body, long slender head, and teeth in its throat and gills rather than jaws (USFWS, 2014d). The pikeminnow was listed as endangered in 1967 (32 FR 4001, March 11, 1967) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.). Regionally, it can be found in Arizona, California, Colorado, New Mexico, and Utah. In Utah, it can be found in 16 counties. In 1994, the species was designated with critical habitat (59 FR 13374 13400, March 21, 1994) in Utah along the Green, Colorado, and Yampa rivers in Uintah, Carbon, Grand, Emery, Wayne, and San Juan counties (USFWS, 2015l).

Historically, the species was endemic throughout the Colorado River Basin, though today, populations occur only in portions of the Green River and upper Colorado River, as well as a small numbers of individuals in the San Juan River. Colorado pikeminnow migrate long distances, swimming hundreds of miles to and from spawning areas. Species habitat requirements include pools, deep runs, and eddies maintained by high spring flows. These high spring flows maintain channel and habitat diversity, flush sediments from spawning areas, rejuvenate food production, form gravel and cobble deposits used for spawning, and rejuvenate backwater nursery habitats. After hatching and emerging from spawning substrate, larvae drift downstream to nursery backwaters. Threats to the species include streamflow regulation, habitat modification, competition with and predation by nonnative fish species, and pesticides and pollutants (USFWS, 2002c).

Greenback Cutthroat Trout. The greenback cutthroat trout is typically a rosy green with dark speckles covering the body. During spawning season, crimson red markings are apparent on the bodies and gills (USGS, 2015k). The species is known to grow to lengths of 17 inches weighing approximately 1 to 2 pounds. The greenback cutthroat trout was initially listed as endangered in 1967 (32 FR 4001, March 11, 1967) and was grandfathered into the ESA of 1973 as an endangered species (Harrington, Winston, 1982). In 1978, the species was downlisted to threatened (43 FR 16343 16345, April 18, 1978). Regionally, it can be found in Colorado and Utah. In Utah, it can be found in San Juan County, in the southeastern corner of the state (USFWS, 2015m). This species inhabits cold water streams and lakes with adequate spawning habitat present in the spring (USFWS, 1998).

Greenback Cutthroat Trout Photo Credit: USFWS

The greenback and the Rio Grande cutthroat trout *(Oncorhynchus clarki virginalis)*, represent the easternmost limits of native trout. Once abundant, their numbers declined through the 19th and 20th centuries to loss of habitat caused by mining and agriculture, over-harvest, and the introduction of non-native trout species. The greenback was eradicated from most of its native range and the species was thought extinct (J.L. Metcalf, 2012). In 1973, two small populations were confirmed that represented approximately 2,000 greenbacks in 4.6 km of stream. Present threats include over harvest from anglers, introduction of non-native species, hybridization with other trout species, and competition with the brook and brown trout (USFWS, 1998).

Humpback Chub. The humpback chub is a long-lived fish growing up to 15 inches long with a pronounced hump from above the gills to its dorsal fin. The species is grey or olive colored on its back with silver sides, a white belly, and rosy fins during mating season (USFWS, 2014e). The humpback chub was listed as endangered in 1967 (32 FR 4001, March 11, 1967) and was grandfathered into the ESA of 1973 as an endangered species. Regionally, it is found in Arizona, Colorado, and Utah. In Utah, it can be found in 16 counties throughout the state. In 1994, the species was designated with critical habitat (59 FR 13374 13400, March 21, 1994) in Utah along the Green and Colorado Rivers in Uintah, Grand, Garfield, and San Juan counties (USFWS, 2015n).

Historically, the humpback chub was endemic to the Colorado River basin, though today populations are restricted to the Colorado, Little Colorado, Green, and Yampa rivers. The largest population is located in the Little Colorado River of the Grand Canyon. Factors such as stream alteration (dams, irrigation, dewatering, and channelization), competition with and predation by nonnative fish species, hybridization with other Gila species may have led to the decline of the humpback chub (USFWS, 1990).

June Sucker. The June Sucker is a dark greyish brown fish with a greenish or white belly and is endemic to Utah Lake and the Provo River in Utah. This fish species typically grows up to 24 inches in length and can weigh up to 6 pounds. The June Sucker likely feeds on zooplankton, aquatic insects, and algae (Quinney Professorship for Wildlife Conflict Management, 1998). This species was simultaneously federally listed as endangered and designated with critical habitat in 1986 (51 FR 10851 10857, March 31, 1986). Critical habitat for this species is located from Utah Lake to the Provo River in Utah (USFWS, 1986a).

Suitable habitat for this species occurs mostly in shallow habitats located in Utah Lake. The June Sucker will swim to the lower Provo River in late May and early June for spawning and larval rearing. Primary threats to this species include drought, pollution, hybridization with other sucker species as well as predation and competition with other fish species. (USFWS, 1999)

Lahontan Cutthroat Trout. The Lahontan Cutthroat Trout is an inland subspecies of cutthroat trout and is endemic to the Lahontan basin located within Nevada, California and Oregon. This multi-colored fish species has a greenish yellow body, silver belly, and reddish sides with small and medium round dark colored spots and varies in both size and weight; it can grow between 10-50 inches in length and will weigh up to 40 pounds. This species was originally federally listed as endangered in 1970 under the Endangered Species Conservation Act of 1969 and reclassified as threatened in 1975 (40 FR 29863 29864, July 16, 1975) due to extensive culturing and successful reintroductions (USFWS, 1995a). Regionally, it can be found in California, Nevada, Oregon, and Utah. In Utah, it can be found in Box Elder County in the northwestern corner of the state (USFWS, 2015o).

Suitable habitat for this species occurs in cool flowing water within the Lahontan Basin. The Lahontan Cutthroat Trout typically feed on terrestrial and aquatic insects. Primary threats to this species include reduction and alteration of stream discharge, degradation of water quality, reduction of lake levels and introduction of non-native fish species (USFWS, 1995a).

Razorback Sucker. The razorback sucker is a long, slender fish growing up to 39 inches in length and weighing up to 12 pounds. The species is marked with dark head and dorsal fins with a yellowish white underbelly and caudal fins (USFWS, 2014d). The razorback sucker was federally listed as endangered in 1991 (56 FR 54957 54967, October 23, 1991). Regionally, it can be found in Arizona, Colorado, Nevada, New Mexico, and Utah. In Utah, it can be found in 16 counties. The razorback sucker was given designated critical habitat in 1994 (59 FR 13374 13400, March 21, 1994) in Utah in the Green, White, Colorado, and Duchesne rivers in Uintah, Carbon, Garfield, Grand, Emery, Wayne, and San Juan counties (USFWS, 2015p).

Historically, the razorback sucker was widely distributed in warm-water reaches of larger rivers of the Colorado River Basin from Mexico to Wyoming. Habitats include features such as "deep runs, eddies, backwaters, and flooded environments in spring; runs and pools often in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools, and eddies in winter… Spawning in rivers occurs over bars of cobble, gravel, and sand substrates during spring runoff at widely ranging flows and water temperatures" (USFWS, 2002d). Threats to the species include changes in streamflow, habitat, and introduction of competitive or predatory nonnative fish species, and pesticides and pollutants (USFWS, 2014d).

Virgin River Chub. The Virgin River Chub is a silvery minnow that averages approximately 8 inches in length. This fish species has very small and deeply embedded scales along the back, belly, and breast that are often difficult to see. The Virgin River chub was first identified as an intermediate species between the roundtail chub (*Gila robusta*) and the bonytail chub (*G. elegans*). The species was later determined to be a subspecies of (*G. robusta*); however, further study led to the recognition of the fish as a separate species named *G. seminude* (USFWS, 2008a). This species was federally listed as endangered in 1989 (54 FR 35305 35311, August

24, 1989). Regionally, it is found in Arizona, Nevada, and Utah. In Utah, it can be found in Washington County in the southwest corner of the state. This species was designated with critical habitat in 2000 (65 FR 4140 4156, January 26, 2000) in Utah, Arizona and Nevada. Historically, the species was abundant in the Virgin River into Southern Nevada, Southwest Utah, and Northwest Arizona. Currently, the extent of the species range is similar; however, it has become extremely rare (USFWS, 2014f). Critical habitat for this species in Utah is designated in portions of the Virgin River in Washington County (USFWS, 2000).

The Virgin River chub prefers deep protected water and relatively fast currents. The species is tolerant of turbidity, salinity, and temperatures below 86 degrees Fahrenheit. Spawning occurs from late spring through early summer and eggs are deposited on rocky substrate with no further care. The species is an opportunistic feeder consuming algae, debris, and invertebrates. Threats to the Virgin River chub come from floods, toxic spills, the diversion of water, disease (including Asian fish tapeworm), and competition from non-native fish (particularly red shiner) (USFWS, 2014f).

Woundfin. The Woundfin is a small, silvery minnow that grows to approximately 3 inches in length. This species primarily feeds on algae, seeds, detritus and various aquatic insects and larvae (USFWS, 2014g). This species was federally listed as endangered in 1970, being grandfathered into the ESA of 1973 (35 FR 16047 16048, October 13, 1970) and was designated with critical habitat in 2000 (65 FR 4140 4156, January 26, 2000). Similar to the Virgin River Chub fish species, critical habitat for this species occurs in in Utah, Arizona and Nevada. Critical habitat for this species in Utah is found "…along portions of the main stem of the Virgin River and its associated 100-year floodplain" (USFWS, 2000).

Suitable habitat for the Woundfin include warm, quiet water habitats with sand substrates within the mainstem of the Virgin River. Historically, this fish species occurred in the Gila, Salt, Moapa and Colorado rivers, however, this species is now restricted to the Virgin River. The primary threats for this species are low flows and high temperatures (USFWS, 2014g).

Invertebrates

One endangered invertebrate species is federally listed for Utah as summarized in Table 16.1.6-7. The Kanab Ambersnail (*Oxyloma haydeni kanabensis*) is found in only one location in the southern portion of the state. Information on the habitat, distribution, and threats to the survival and recovery of this species in Utah is provided below.

Table 16.1.6-7: Federally Listed Invertebrate Species of Utah

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Utah	Habitat Description
Kanab Ambersnail	*Oxyloma haydeni kanabensis*	E	No	Marshes and other wetlands watered by springs and seeps. Found in Three Lakes, Kane County, in southern Utah.

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

Kanab Ambersnail. The Kanab Ambersnail is a member of the crustacean and mollusk family. This species is a terrestrial snail that has an amber colored shell and is approximately a half inch in length. The Kanab Ambersnail was listed as an endangered species in 1991 via an emergency rule, due to existing and potential habitat degradation caused by private land development at Three Lakes (56 FR 37668 37671, August 8, 1991) (USFWS, 1992a) (USFWS, 1995b). In Utah, it is found in Kane County, in the southern part of the state (USFWS, 2015q).

Suitable habitat for the Kanab Ambersnail consists of marshes and other wetland areas that are watered by springs and seeps. These snails are hermaphroditic and are found in association with monkeyflower, watercress, and sedges. There are only two known natural populations of this species in the United States, which are located in Vasey's Paradise, AZ, and Three Lakes, UT. The Kanab Ambersnail population in Three Lakes, UT is located on private land. The private landowner restricts public access to this location in an effort to preserve the habitat. The primary threat associated with the Three Lakes population of the species is habitat destruction due to the fact that the habitat location is located in a prime tourism corridor that connects to Bryce Canyon, Grand Canyon, and Zion National Parks (USFWS, 2011a).

Plants

Twelve endangered and 13 threatened plant species are federally listed for Utah as summarized in Table 16.1.6-8. The Maguire primrose (*Primula maguirei*) occurs in northern Utah and the Barneby ridge-cress (*Lepidium barnebyanum*) and Clay reed-mustard (*Schoenocrambe argillacea*) occur in northeastern Utah. The Autumn Buttercup (*Ranunculus acriformis var. aestivalis*), occurs in western Utah. The Jones cycladenia (*Cycladenia humilis var. jonesii*), Pariette cactus (*Sclerocactus brevispinus*), shrubby reed-mustard (*Schoenocrambe suffrutescens*), and the Uinta Basin hookless cactus (*Sclerocactus wetlandicus*) occur in eastern Utah. The Jones cycladenia, Kodachrome bladderpod (*Lesquerella tumulosa*), Siler Pincushion cactus (*Pediocactus sileri*), Welsh's milkweed (*Asclepias welshii*), and the Wright Fishhook cactus (*Sclerocactus wrightiae*) occur in southern Utah. The Dwarf Bear-poppy (*Arctomecon humilis*), Gierisch mallow (*Sphaeralcea gierischii*), Holmgren milk-vetch (*Astragalus holmgreniorum*), and the Shivwits milk-vetch (*Astragalus ampullarioides*) occur in southwestern Utah. The Navajo sedge (*Carex specuicola*) occurs in southeastern Utah. The Barneby reed-mustard (*Schoenocrambe barnebyi*), Clay phacelia (*Phacelia argillacea*), Deseret milk-vetch (*Astragalus desereticus*), Heliotrope milk-vetch (*Astragalus montii*), Last Chance townsendia (*Townsendia aprica*), San Rafael cactus (*Pediocactus despainii*), and the Winkler cactus (*Pediocactus winkleri*) occur in central Utah. The Ute ladies'-tresses (*Spiranthes diluvialis*) occurs throughout Utah (USFWS, 2015ah). The Frisco buckwheat (*Eriogonum soredium*), Frisco clover (*Trifolium friscanum*), and Ostler's peppergrass (*Lepidium ostleri*) have been identified by USFWS as candidate species in Utah (USFWS, 2015c). Information on the habitat, distribution, and threats to the survival and recovery of each of these listed species in Utah is provided below.

Table 16.1.6-8: Federally Listed Plant Species of Utah

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Utah	Habitat Description
Autumn Buttercup	*Ranunculus aestivalis*	E	No	Occurs only in Sevier River Valley in western Garfield County, Utah.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Utah	Habitat Description
Barneby Reed-mustard	*Schoenocrambe barnebyi*	E	No	Red clay soils that are covered with sandstone talus on steep slopes facing north. Found in Emery and Wayne counties in central Utah.
Barneby Ridge-cress	*Lepidium barnebyanum*	E	No	Poorly developed soils on lime-rich mud shale barrens occurring over petroleum deposits. Found in Duchesne County, northeastern Utah.
Clay Phacelia	*Phacelia argillacea*	E	No	A limited strip of soil called Green River Shale on steep hillsides of shale clay. Found in Utah County, central Utah.
Clay Reed-mustard	*Schoenocrambe argillacea*	T	No	Gypsum-rich clay covered in sandstone talus on steep hillsides. Found in Uintah County, northeastern Utah.
Deseret Milk-vetch	*Astragalus desereticus*	T	No	Sandy-gravelly, steep, erosive hillsides in sagebrush-juniper communities of the Moroni Formation near Birdseye, Utah. Found in Utah County, central Utah.
Dwarf Bear-poppy	*Arctomecon humilis*	E	No	Selected sites on the Moenkopi formation from 2,700 to 3,300 feet in elevation. Found in Washington County, in the southwestern corner of Utah.
Gierisch Mallow	*Sphaeralcea gierischii*	E	Yes; Starvation Point in Washington County, Utah.	Gypsum outcrops associated with the Harrisburg Member (topmost geologic layer) of the Kaibab Formation, within warm desert scrub plant community. Found in Washington County in the southwestern corner of Utah.
Heliotrope Milk-vetch	*Astragalus montii*	T	Yes; western Heliotrope Mountain in Sanpete County, Utah.	Shallow, poorly developed clay soil covered with rocks on shale limestone barrens over coal and petroleum deposits at the timberline of the Flagstaff Geological Formation. Found in Sanpete and Sevier counties, central Utah.
Holmgren Milk-vetch	*Astragalus holmgreniorum*	E	Yes; 23 units in Washington County, Utah.	Elevations between 2,480 and 2,999 feet in soils with small stone and gravel deposits on the skirt edges of hill and plateau formations that are a little above or at the edge of drainage areas that drain to the Santa Clara and Virgin rivers. Found in Washington County, in the southwest corner of Utah.
Jones Cycladenia	*Cycladenia humilis var. jonesii*	T	No	Gypsum-rich, salty soils in plant communities of mixed desert scrub, juniper, or wild buckwheat-Mormon tea at elevations of 4,390 to 6,000 feet. Found in Emery, Garfield, Grand, and Kane counties, in the eastern and southern portions of Utah.
Kodachrome Bladderpod	*Lesquerella tumulosa*	E	No	White, bare shale mounds with not much vegetation at an elevation of about 5,700 feet. Found in Kane County, southern Utah.
Last Chance Townsendia	*Townsendia aprica*	T	No	Fine-textured shale soils in a variety of plant communities such as saltbush, pinyon-juniper woodlands, and ponderosa pine woodlands, within the Moenkopi Formation, Morrison Formation, Mancos Shale Group, and the San

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Utah	Habitat Description
				Rafael Group. Found in Emery, Sevier, and Wayne counties, central Utah.
Maguire Primrose	*Primula maguirei*	T	No	Cool, moss-covered dolomite, north-facing cliff tops, indentations, and boulders in patches of soil. Found in Logan Canyon in Cache County, northern Utah.
Navajo Sedge	*Carex specuicola*	T	No	Moist soil in shallow caves on sandstone cliffs at elevations of 4,200 to 7,600 feet in pinon-juniper woodland communities. Found in San Juan County, in the southeastern corner of Utah.
Pariette Cactus	*Sclerocactus brevispinus*	T	No	Fine soils, frequently covered in thin rock fragments, on gravelly hills in desert shrubland with little vegetation. Found in Duchesne and Uintah counties, eastern Utah.
San Rafael Cactus	*Pediocactus despainii*	E	No	Fine textured soils that are rich in calcium from limestone substrates; mainly on benches, hill tops, and gentle slopes facing south; in open woodlands of pinyon-juniper woodland plant communities. Found in Emery and Wayne counties, central Utah.
Shivwits Milk-vetch	*Astragalus ampullarioides*	E	Yes; 5 units of Washington County, Utah.	Grows in dense patches in secluded pockets of purple colored, soft clay soil found on the Chinle formation at elevations between 3,018 and 4,363 feet with not a lot of vegetation. Found in Washington County, in the southwestern corner of Utah.
Shrubby Reed-mustard	*Schoenocrambe suffrutescens*	E	No	A limited strip of soil on a white shale layer from the Green River geologic formation that looks like small, dry, desert islands. Found in Duchesne and Uintah counties, eastern Utah.
Siler Pincushion Cactus	*Pediocactus sileri*	T	No	Gypsum and calcium-rich clay soils that are high in soluble salts and usually white in color, though are sometimes red; on low, rolling hills supporting sparse vegetation. Found in Kane and Washington counties, in southern Utah.
Uinta Basin Hookless Cactus	*Sclerocactus wetlandicus*	T	No	Coarse soils from cobble and gravel river and stream deposits, or rocky surfaces on plateau slopes at elevations between 4,400 and 6,200 feet. Found in Carbon, Duchesne, and Uintah counties, eastern Utah.
Ute Ladies'-tresses	*Spiranthes diluvialis*	T	No	Moist soils in wetlands, wet meadows, and swales near perennial streams or lakes with vegetation that is not too dense. Found in 11 counties throughout Utah.
Welsh's Milkweed	*Asclepias welshii*	T	Yes; the Coral Pink Sand Dunes and the Sand Hills in Kane County, Utah.	Unstable aeolian sand on active sand dunes in plant communities mostly consisting of sand, but also including groves of ponderosa pine and Gambel oak. Found in Kane County, in southern Utah.
Winkler Cactus	*Pediocactus winkleri*	T	No	Benches, hill tops, and gentle slopes facing south in fine textured, somewhat alkaline soils

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Utah	Habitat Description
				from siltstone and shale substrates of the Dakota and Morrison formations. Found in Emery, Garfield, Sevier, and Wayne counties, central Utah.
Wright Fishhook Cactus	*Sclerocactus wrightiae*	E	No	Most soil it grows in has at least some cryptogamic crust, and is scattered with sandstone or basalt gravel, cobble, and boulders. It grows in gypsum-rich layers as well as areas with little to no gypsum. The surrounding habitat is usually dry and consists of widely spaced shrubs, herbs, bunch grasses, or pinyon and juniper with not a lot of surface coverage. Found in Emery, Garfield, Sevier, and Wayne counties, southern Utah.

Source: (USFWS, 2015ah)

[a] E = Endangered, T = Threatened

Autumn Buttercup. The autumn buttercup is an herbaceous perennial plant that grows between 1 and 2 feet in length that blooms from July through early October. It typically produces 6 to 10 ½ inch yellow flowers per plant This plant species was federally listed as endangered in 1989 (54 FR 30550 30554, July 21, 1989). The autumn buttercup is found in the Sevier River Valley in western Garfield County, Utah. Suitable habitat for this species occurs in wet, saline meadow habitats. Primary threats to this species include agricultural uses, livestock grazing and natural events such as wildlife grazing. (USFWS, 1991) (USFWS, 2016b)

Barneby Reed-mustard. The Barneby reed-mustard is a small, herbaceous plant that usually grows up to 9 inches tall, but sometimes reaches 15 inches in height. It does not have many leaves, and has two to eight light purple flowers with darker purple veins on each of the flower petals. The flowers grow to be 0.4 inches long and 0.1 inches wide, and grow at the end of the leafy stems. The stems are woody and have small, 0.5 inch long green leaves that alternate up the stem to about halfway from the base of the plant. The Barneby reed-mustard was federally listed as endangered in 1992 (57 FR 1398 1403, January 14, 1992). This species only occurs in Emery and Wayne counties in central Utah. (USFWS, 2015r)

It inhabits red clay soils that are covered with sandstone talus on steep slopes facing north. Threats to the Barneby reed-mustard include habitat destruction due to mining activities, recreational foot traffic, and road and recreational development. It is also highly vulnerable due to its small and restricted population size (USFWS, 1994).

Barneby Ridge-cress. The Barneby ridge-cress is a perennial, herbaceous plant in the mustard family that grows from 2 to 6 inches tall and forms raised clumps that reach up to 8 inches in width. It has a deep woody root with smooth hairless stems and narrow leaves clustered at the base of the plant. It blooms in early May with cream colored flowers that measure 0.25 inches wide and grow alternately along a stem 1 to 2.5 inches above the base of the plant. The Barneby ridge-cress was federally listed as endangered in 1990 (55 FR 39860 39864, September 28, 1990). This species can only be found in Duchesne County, northeastern Utah. (USFWS, 2015s)

It inhabits poorly developed soils on lime-rich mud shale barrens occurring over petroleum deposits. Threats to the Barneby ridge-cress include habitat destruction due to oil and gas exploration, drilling, and production, as well as off-road vehicle damage. (USFWS, 1993)

Clay Phacelia. The Clay phacelia is a biennial that grows from 4 to 14 inches in height and has blue to violet flowers. Rosettes form at the plant base in October, with germination occurring in late summer and early fall. The Clay phacelia was federally listed as endangered in 1978 (43 FR 44810 44811, September 28, 1978). This species can only be found in Utah County, central Utah. (USFWS, 2015t)

It inhabits a limited strip of soil called Green River Shale on steep hillsides of shale clay. The soil is made up of a mix of clay, silt, and sand, with pebble and shale covering it. Threats to the Clay Phacelia include habitat loss and modification due to construction railroads and associated service roads, as well as sheep trampling, highway improvements, and invasive species. (USFWS, 2013e)

Clay Reed-mustard. The Clay reed-mustard is a perennial, herbaceous plant that grows from 6 to 12 inches tall and has a woody root and not many leaves on its stems. The leaves are very narrow, growing 0.4 to 1.4 inches long and less than 0.1 inches wide. The leaves grow alternately on the stem and are attached directly to the stem without a leaf stem. The flowers are pale lavender to whitish with purple veins growing 0.3 to 0.4 inches long and 0.14 to 0.18 inches wide, and form in groups of three to 20 flowers at the end of the stems. The Clay reed-mustard was federally listed as threatened in 1992 (57 FR 1398 1403, January 14, 1992). This species can only be found in Uintah County, northeastern Utah. (USFWS, 2015u)

It inhabits gypsum[93]-rich clay covered in sandstone talus on steep hillsides. Threats to the Clay reed-mustard include habitat loss and modification due to oil and gas development, and erosion and sedimentation. (USFWS, 2011b)

Deseret Milk-vetch. The Deseret milk-vetch is a perennial, herbaceous member of the bean family that grows 2 to 6 inches in height from the base of a 2 inch herbaceous stem. The silvery gray hair covered leaves are feather-like, with 11 to 17 leaflets 2 to 4 inches long, and grow on both sides of a central stalk. The seed pods are covered with dense hairs and are 0.4 to 0.8 inches long. The flower petals are either completely white or whitish with pinkish wings and a lilac keel[94]-tip. The Deseret milk-vetch was federally listed as threatened in 1999 (64 FR 56590 56596, October 20, 1999). This species can only be found in Utah County, central Utah. (USFWS, 2015v)

It inhabits the sandy-gravelly, steep, erosive hillsides in sagebrush-juniper communities of the Moroni Formation near Birdseye, Utah. Habitat loss and modification is no longer a threat to the

[93] A soft white or gray mineral consisting of hydrated calcium sulfate.
[94] A prow-shaped pair of petals present in flowers of the pea family.

Deseret milk-vetch, since most of its habitat occurs on state-managed land. However, climate change has the potential to be a threat to this species. (USFWS, 2011c)

Dwarf Bear-poppy. The Dwarf Bear-poppy is a perennial herb with tufts of leaves at its base. It has short, leafy flower stalks with white, four-petalled flowers that appear to float above the leaves cluster. The name comes from the shaggy leaves that resemble a bear paw. The Dwarf Bear-poppy was federally listed as endangered in 1979 (44 FR 64250 64252, November 6, 1979). This species can only be found in Washington County, in the southwestern corner of Utah. (USFWS, 2015w)

It inhabits erosive, alkaline clay soil as well as erosive, nonalkaline, gypsum-rich soil in an area called the Dixie Corridor, where the creosote-dominated vegetation of the Mohave Desert grows on the sedimentary strata of the Colorado Plateau. Specifically, it grows on selected sites on the Moenkopi formation from 2,700 to 3,300 feet in elevation. Threats to the dwarf bear-poppy include habitat loss and modification due to increasing development and off-road vehicle use, both recreational and mineral exploration related. (USFWS, 1985a)

Gierisch Mallow. The Gierisch mallow is a perennial, flowering plant with a woody base that produces dark red-purple colored stems and orange flowers. The Gierisch mallow was federally listed as endangered in 2013 (78 FR 49149 49165, August 13, 2013). Critical habitat was established at time of listing in 2013 (78 FR 49165 49183, August 13, 2013). Regionally, this species can be found in Arizona and Utah. In Utah, it can be found in Washington County in the southwestern corner of the state. (USFWS, 2015z)

Critical habitat is designated at Starvation Point in Washington County, Utah (USFWS, 2013f). It inhabits gypsum outcrops associated with the Harrisburg Member (topmost geologic layer) of the Kaibab Formation, within warm desert scrub plant community. Threats to the species include habitat destruction and modification from mining operations, recreational activities, and wildfires associated with the spread of nonnative grass species (USFWS, 2013g).

Heliotrope Milk-vetch. The Heliotrope milk-vetch is a perennial, herbaceous plant in the legume family. It is nearly stemless and very low growing, reaching 0.4 to 2 inches in height. The leaves are 0.5 to 2 inches long with 5 to 13 leaflets that are 0.08 to 0.32 inches long and 0.04 to 0.08 inches wide and sheath the stem. It has two to eight flowers that are pinkish purple with white wings on a 0.3 to 1.8 inch long flower stem. The thick, mottled pinkish brown colored seed pods are oval shaped and inflated, with ten seeds inside (USFWS, 1995c). The Heliotrope milk-vetch was federally listed as threatened in 1987 (52 FR 42652 42657, November 6, 1987). This species can only be found in Sanpete and Sevier counties, central Utah (USFWS, 2015aa).

Critical habitat was designated at time of listing in 1987 (52 FR 42652 42657, November 6, 1987) on western Heliotrope Mountain in Sanpete County, Utah. It inhabits shallow, poorly developed clay soil covered with rocks on shale limestone barrens over coal and petroleum deposits at the timberline of the Flagstaff Geological Formation. Threats to the Heliotrope milk-vetch include future development of oil and gas wells, as well as overgrazing by domestic sheep (USFWS, 1995c).

Holmgren Milk-vetch. The Holmgren milk-vetch is a perennial, non-woody herbaceous member of the pea family. It grows close to the ground with its leaves pressed close to the ground. The leaves are 1.5 to 5.1 inches long with nine to 15 leaflets 0.3 to 0.6 inches long and oval-shaped, becoming narrow towards the base of the leaf. It grows small purple flowers in the spring that are 0.7 to 0.9 inches long, 0.2 to 0.4 inches wide, and have five petals. They grow along the stalk in groups of six to 16. It has fruit pods that are 1 to 2 inches long and 0.2 to 0.4 inches wide that eventually dry out with age and open up at the top and bottom. The Holmgren milk-vetch was federally listed as endangered in 2001 (66 FR 49560 49567, September 28, 2001). Regionally, this species is found in Arizona and Utah. In Utah, it can be found in Washington County, in the southwest corner of the state (USFWS, 2015ab).

Critical habitat was established in 2006 (71 FR 77972 78012, December 27, 2006) in two units in Washington County, Utah (USFWS, 2006b). Holmgren milk-vetch is thinly distributed in elevations between 2,480 and 2,999 feet in soils with small stone and gravel deposits on the skirt edges of hill and plateau formations that are a little above or at the edge of drainage areas that drain to the Santa Clara and Virgin rivers. Threats to this species include land development, urban expansion, invasive plant species, and the potential of drought brought about by climate change (USFWS, 2006c).

Jones Cycladenia. The Jones cycladenia is a perennial herbaceous herb that grows 4 to 6 inches tall. It has a long underground stem system, oval-shaped leaves and grows pink or rose-colored flowers that are trumpet-shaped and resemble small morning glories (USFWS, 2008b). The Jones cycladenia was federally listed as threatened in 1986 (51 FR 16526 16530, May 5, 1986). Regionally, this species is found in Arizona and Utah. In Utah, it can be found in Emery, Garfield, Grand, and Kane counties, in the eastern and southern portions of the state (USFWS, 2015ac).

It inhabits gypsum-rich, salty soils in plant communities of mixed desert scrub, juniper, or wild buckwheat-Mormon tea at elevations of 4,390 to 6,000 feet. Threats to the Jones cycladenia include off-road vehicle use; oil, gas, and mineral exploration; and livestock grazing (USFWS, 2008b).

Kodachrome Bladderpod. The Kodachrome bladderpod is a perennial herbaceous plant in the mustard family. Its root crown forms a dense mound of growth, resembling a cushion. These branches are covered with many leaves that are withering but not falling off. Its stems are 0.4 to 1.6 inches tall with leaves forming mostly at the base. The leaves are narrow, 0.1 to 0.4 inches long and about 0.05 inches wide, with fine, soft, short hairs arranged in a star pattern on them. The flowers have yellow petals 0.2 to 0.3 inches long, with an egg-shaped fruit 0.1 inches long, that is a seed capsule with two chambers containing two to four seeds and separates when ripe (USFWS, 2009a). The Kodachrome bladderpod was federally listed as endangered in 1993 (58 FR 52027 52030, October 6, 1993). This species is only found in Kane County, southern Utah (USFWS, 2015ad).

It inhabits white, bare shale mounds with not much vegetation at an elevation of about 5,700 feet. Threats to the Kodachrome bladderpod include gravel quarries, oil and gas development, new road construction, off-road vehicle use, and cattle grazing. (USFWS, 2009a)

Last Chance Townsendia. The Last Chance townsendia is a small, stemless, perennial plant in the sunflower family. It forms a mound, growing from 0.6 to 1 inch tall, with small leaves 0.28 to 0.52 inches long and 0.14 inches wide. The flowers are apricot colored and each flower head grows about 35 flowers. The fruit is ribbed and contains one seed (USFWS, 2013h). The Last Chance townsendia was federally listed as threatened in 1985 (50 FR 33734 33737, August 21, 1985). This species is only found in Emery, Sevier, and Wayne Counties, central Utah (USFWS, 2015ae).

It inhabits fine-textured shale soils in a variety of plant communities such as saltbush, pinyon-juniper woodlands, and ponderosa pine woodlands, within the Moenkopi Formation, Morrison Formation, Mancos Shale Group, and the San Rafael Group. Threats to the Last Chance townsendia include energy and mineral related development, livestock grazing, wild horses and burros, and off-road vehicle use. (USFWS, 2013h)

Maguire Primrose. The Maguire primrose is a perennial, herbaceous plant that grows 2 to 4 inches tall. Its leaves are oval-shaped and grow 2 inches long and 0.5 inches wide. It has two types of reddish-lavender flowers; one produces seeds, and the other produces pollen (USFWS, 2011d). The Maguire primrose was federally listed as threatened in 1985 (50 FR 33731 33734, August 21, 1985). This species is only found within Logan Canyon in Cache County, northern Utah (USFWS, 2015af).

It inhabits cool, moss-covered dolomite[95], north-facing cliff tops, indentations, and boulders in patches of soil. Threats to the Maguire primrose include recreational rock climbing, invasive species, and risks associated with having a smaller population, such as increased vulnerability to change. (USFWS, 2011d)

Navajo Sedge. The Navajo sedge is a grass-like, slender perennial forb in the sedge family. The stems are 6 to 20 inches long, not upright, and generally longer than the leaves. Many of the stems grow from an underground stem, which gives the plant a clumped shape, often forming mats with a dried leaf base. The flowers are male and female, with male flowers growing on the end of the stem, and female flowers growing below (USFWS, 2014j). The Navajo sedge was federally listed as threatened in 1985 (50 FR 19370 19374, May 8, 1985). Regionally, this species is found in Arizona and Utah. In Utah, it can be found in San Juan County, in the southeastern corner of the state (USFWS, 2015ag).

It inhabits moist soil in shallow caves on sandstone cliffs at elevations of 4,200 to 7,600 feet in pinon-juniper woodland communities. Threats to the Navajo sedge include water withdrawals from Colorado Basin aquifers as well as the potential of increased temperature and altered precipitation patterns due to climate change. (USFWS, 2014j)

Pariette Cactus. The Pariette cactus is a barrel-shaped, ribbed cactus that grows from 1 to 3.4 inches tall and up to 2 inches wide. It has spines that are clustered on the tips of rounded projections along the ribs of the cactus. There are two types of spines; the central spine is short (0.08 to 0.2 inches long) and descending, with the radial spines surrounding it. The bell-shaped pink to purple colored flowers grow about 0.6 inches high and 1.2 inches wide. The green fruit

[95] A translucent mineral consisting of a carbonate of calcium and magnesium.

ripens to be brown, and dry with about 15 to 30 seeds that are 0.06 inches wide and 0.1 inches long (USFWS, 2014l). The Pariette cactus was federally listed as threatened in 2009 (74 FR 47112 47117, September 15, 2009). This species is only found in Duchesne and Uintah counties, eastern Utah (USFWS, 2015ai).

It inhabits fine soils, frequently covered in thin rock fragments, on gravelly hills in desert shrubland with little vegetation. Threats to the Pariette cactus include habitat loss and modification due to energy development, livestock grazing and trampling, nonnative invasive plants, climate change, and drought (USFWS, 2014l).

San Rafael Cactus. The San Rafael cactus is a small, oval-shaped, leafless, stem cactus. Its stems are 1.5 to 2.5 inches tall and 1.2 to 3.7 inches wide. The stems are ribbed with rounded projections 0.25 to 0.4 inches long and 0.2 to 0.45 inches wide, that have spines at the top. There are nine to 13 radial spines, which are white in color, spreading, and 0.08 to 0.24 inches long. The yellow bronze to peach bronze colored flowers grow on the upper end of these projections and are 0.6 to 1 inch long and 0.7 to 1 inch wide. The smooth fruit is 0.35 to 0.45 inches long, 0.4 to 0.5 inches wide, starts out green and turns a reddish-brown color with age. The shiny black, kidney-shaped seeds have mounds that form ridges along its surface, and are 0.14 inches long and 0.1 inches wide (USFWS, 1995d). The San Rafael cactus was federally listed as endangered in 1987 (52 FR 34914 34917, September 16, 1987). This species is only found in Emery and Wayne counties, central Utah (USFWS, 2015aj).

It inhabits fine textured soils that are rich in calcium from limestone substrates; mainly on benches, hill tops, and gentle slopes facing south; in open woodlands of pinyon-juniper woodland plant communities (USFWS, 1995d). Threats to the San Rafael cactus include collection for horticultural purposes, off-road vehicle use, livestock trampling, drought, climate change, and exotic plant species (USFWS, 2007a).

Shivwits Milk-vetch. The Shivwits milk-vetch is a tall member of the pea family with stems growing either along the ground or up to a height of 8 to 20 inches. The leaves grow opposite from each other, are 1.6 to 7.1 inches long, and have 11 to 23 leaflets. Each plant grows about 45 small, cream colored flowers that are about 0.8 inches long on a single stalk in the spring. Seeds grow in small, short, broad pods that measure between 0.3 to 0.6 inches long and 0.2 to 0.5 inches wide (USFWS, 2006d). The Shivwits milk-vetch was federally listed as endangered in 2001 (66 FR 49560 49567, September 28, 2001). This species is only found in Washington County, in the southwestern corner of Utah (USFWS, 2015ak). Critical habitat was established in 2006 (71 FR 77972 78012, December 27, 2006) in five units of Washington County, Utah (USFWS, 2006e).

It grows in dense patches in secluded pockets of soft purple clay soil found on the Chinle formation at elevations between 3,018 and 4,363 feet with sparse vegetation. Threats to the Shivwits milk-vetch include off-road vehicle and other recreational uses, invasive plants and the fires associated with them, long droughts due to climate change, and herbivory. (USFWS, 2006d)

Shrubby Reed-mustard. The shrubby reed-mustard is a perennial herb in the mustard family with clumped stems growing 4 to 12 inches tall from a branching woody crown of roots. The leaves are 0.4 to 1 inches long and 0.12 to 0.4 inches wide, and grow alternately on the stem, attached by a short leaf stem. The five to 20 flowers grow along the leafy stem and have petals that are light yellow or greenish yellow in color and measure about 0.4 inches long and 0.12 inches wide. The shrubby reed-mustard was federally listed as endangered in 1987 (52 FR 37416 37420, October 6, 1987). This species is only found in Duchesne and Uintah counties, eastern Utah. (USFWS, 2015al)

It inhabits a limited strip of soil on a white shale layer from the Green River geologic formation that looks like small, dry, desert islands. The biggest threat to the shrubby reed-mustard is habitat loss and modification due to energy development, as its entire range was leased for oil and gas development and its habitat lies over oil shale deposits. (USFWS, 2010b)

Siler Pincushion Cactus. The Siler Pincushion cactus is a small, solitary or sometimes clustered, globelike cactus reaching about 4 inches tall and 3 to 4 inches wide. Each areole[96] has three to seven brownish-black colored, straight or curved 1 inch long central spines, which turn a pale gray or almost white color as the plant ages. There are also 11 to 16 whitish colored, less than 1 inch long radial spines on each areole. The flowers grow to about 1 inch wide, and have yellowish colored petals with maroon veins. The fruits are greenish-yellow in color and have scales at the top. They dry out as they age, and the seeds are gray colored (USFWS, 1986b). The Siler Pincushion cactus was federally listed as threatened in 1979 (44 FR 61786 61788, October 26, 1979). Regionally, this species is found in Arizona and Utah. In Utah, it can be found in Kane and Washington counties, in the southern portion of the state (USFWS, 2015am).

It inhabits gypsum and calcium-rich clay soils that are high in soluble salts and usually white in color, though they are sometimes red; on low, rolling hills supporting sparse vegetation (USFWS, 1986b). Threats to the Siler Pincushion include mining, oil and gas leases, off-road vehicle use, commercial and residential development, and long-term drought (USFWS, 2009b).

Uinta Basin Hookless Cactus. The Uinta Basin hookless cactus is a barrel-shaped cactus that grows from 1.5 inches to 7 inches tall, sometimes reaching 12 inches in height. The stems usually have 12 to 15 ribs that grow from the ground up to the tip of the cactus. Along the ribs, areoles have hooked spines, including six to 14 white or gray to light brown colored radial spines, measuring 0.24 to 0.8 inches long, and growing around the edges of the areole, parallel to the cactus body; and one to five central spines, measuring 0.5 to 2 inches long, and extending out from the areole center. The 0.8 to 2 inch long and 0.8 to 2 inch wide flowers are funnel-shaped and have pink to violet colored petal-like flower parts with yellow stamens. The 0.3 to 0.5 inches wide and 0.35 to 1 inch long fruit is short, barrel-shaped, and is reddish or reddish gray colored when ripe. The Uinta Basin hookless cactus was federally listed as threatened in 2009 (74 FR 47112 47117, September 15, 2009). This species is only found in Carbon, Duchesne, and Uintah counties, eastern Utah. (USFWS, 2015an)

[96] Areole: "Structure on a cactus that bear spines, buds, flowers, and then fruits" (NPS, 2016c).

It inhabits coarse soils from cobble and gravel river and stream deposits, or rocky surfaces on plateau slopes at elevations between 4,400 and 6,200 feet. The main threat to the Uinta Basin hookless cactus is habitat loss and modification due to energy development. (USFWS, 2010c)

Ute Ladies'-tresses. The Ute ladies'-tresses is a perennial herb with stems reaching from 4 to 24 inches tall. The leaves at the base are up to 0.4 inches wide and 11 inches long, with leaves becoming smaller and alternate further up the stem. The many small, white or ivory colored flowers are arranged in a spiral on a 1 to 6 inch long spike, and smell faintly like vanilla. The fruits are round with many seeds inside. The Ute ladies'-tresses was federally listed as threatened in 1992 (57 FR 2048 205, January 17, 1992). Regionally, this species is found in Colorado, Idaho, Montana, Nebraska, Nevada, Utah, Washington, and Wyoming. In Utah, it can be found in 11 counties throughout the state. (USFWS, 2015ao)

It inhabits moist soils in wetlands, wet meadows, and swales near perennial streams or lakes with vegetation that is not too dense. Threats to this species include urbanization, agriculture, recreation, grazing, and invasion by nonnative species. (USFWS, 1995e)

Welsh's Milkweed. The Welsh's milkweed is a tall, herbaceous plant in the milkweed family. The stems can reach up to 40 inches tall and grow alone or in clusters of about 10 from roots that have running roots connecting the clusters. The leaves grow in opposite pairs along the stems, with larger upper leaves above 3 inches long and 2 inches wide, and smaller lower leaves. The leaves and stems are covered in dense white colored wooly hairs early in the growing season, but by the end of the season these hairs are rubbed off by blowing sand. There are about 30 cream colored flowers with a rose-tinted center that grow in a circular pattern about 3 inches wide at the end of a small stalk. The seeds are large for the milkweed family, reaching about 1 inch long (USFWS, 1992b). The Welsh's milkweed was federally listed as threatened in 1987 (52 FR 41435 41441, October 28, 1987). Regionally, this species is found in Arizona and Utah. In Utah, it can be found in Kane County, in the southern portion of the state (USFWS, 2015ap).

Critical habitat was established in 1987 (52 FR 41435 41441, October 28, 1987) in the Coral Pink Sand Dunes and the Sand Hills in Kane County, Utah. It inhabits unstable aeolian[97] sand on active sand dunes in plant communities mostly consisting of sand, but also including groves of ponderosa pine and Gambel oak. The surrounding habitat consists of stabilized sands with vegetation, sandstone, or different exposed shales or other fine grained exposed rocks types. The greatest threat to the Welsh's milkweed is habitat destruction due to off-road vehicle use. (USFWS, 1992b)

Winkler Cactus. The Winkler cactus is a small, egg-shaped cactus with stems growing alone or in clumps from 1.5 to 2.7 inches tall, and 1.1 to 2 inches wide. The stems are ribbed with rounded projections 0.15 to 0.3 inches long and 0.2 to 0.3 inches wide with spines on areoles at the top. The areoles have dense wooly hair and nine to 11 radial spines that are white tan in color and spread downward. The peach to pink colored flowers are 0.7 to 0.9 inches long, 0.7 to 1.2 inches wide, and grow on the upper end of the projections near the top of the stem. The smooth fruit is 0.3 to 0.4 inches long, 0.3 to 0.45 inches wide, and starts out green but turns a

[97] Relating to or arising from the action of the wind.

reddish-brown color and splits open along a vertical slit with age. The shiny, kidney-shaped, black seeds have mounds that form ridges and are 0.12 inches long and 0.08 inches wide (USFWS, 1995f). The Winkler cactus was federally listed as threatened in 1998 (63 FR 44587 44595, August 20, 1998). This species is only found in Emery, Garfield, Sevier, and Wayne counties, central Utah (USFWS, 2015aq).

It inhabits benches, hill tops, and gentle slopes facing south in fine textured, somewhat alkaline soils from siltstone and shale substrates of the Dakota and Morrison formations. The vegetative community surrounding it is made up of drought tolerant shrubs and grasses, including cacti (USFWS, 1995f). The greatest threats to the Winkler cactus are over collection, off-road vehicle use, and livestock trampling; other minor threats include mineral exploration, drought, and natural herbivory and predation (USFWS, 2007b).

Wright Fishhook Cactus. The Wright Fishhook cactus is a globelike ribbed cactus growing 2 inches tall and 2 to 3 inches wide. The areoles have four dark to light brown central spines, the lower one of which is hooked, and eight to 10 white radial spines that are straight. The inch-wide flowers have light reddish-brown, reddish-green, or lavender colored middles and pale pink to white colored edges. The fruit is barrel-shaped with small seeds (USFWS, 1985b). The Wright Fishhook cactus was federally listed as endangered in 1979 (44 FR 58866 58868, October 11, 1979). This species is only found in Emery, Garfield, Sevier, and Wayne counties, southern Utah (USFWS, 2015ar).

Most soil it grows in has at least some cryptogamic[98] crust, and is scattered with sandstone or basalt gravel, cobble, and boulders. It grows in gypsum-rich layers as well as areas with little to no gypsum. The surrounding habitat is usually dry and consists of widely spaced shrubs, herbs, bunch grasses, or pinyon and juniper with not a lot of surface coverage (USFWS, 1985b). Threats to the Wright Fishhook cactus include off-road vehicle use, livestock trampling, and predation by cactus borer beetles (USFWS, 2008c).

16.1.7. Land Use, Recreation, and Airspace

16.1.7.1. Definition of the Resources

The following summarizes major land uses, recreational venues, and airspace considerations in Utah, 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

[98] Covered with or consisting of a fragile black layer of cyanobacteria, mosses, and lichens.

sensing and mapping, on the earth's surface; land cover includes vegetation and manmade development (USGS, 2012c).

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

Descriptions of land uses are presented in five primary land use groups: semi-desert, forest and woodland, shrub and grassland, agriculture, and developed land. Descriptions of land ownership are presented in four main categories: private, federal, state, and tribal. Descriptions of recreational opportunities are presented in a regional fashion.

Airspace

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

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

The FAA Air Traffic Services Unit (the Unit) manages the National Airspace System (NAS) and international airspace assigned to U.S. control and is responsible for ensuring efficient use, security, and safety of the nation's airspace. FAA field and regional offices (e.g., Aircraft Certification Offices, Airports Regional Offices, Flight Standards District Offices [FSDOs], Regional Offices and 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, 2015d). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

16.1.7.2. Specific Regulatory Considerations

Section 1.8, Overview of Relevant Federal Laws and Executive Orders, and Appendix C, Environmental Laws and Regulations, summarize numerous federal environmental laws and regulations that, to one degree or another, may affect land use in Utah. However, most site-specific land use controls and requirements are governed by local county, city, and village laws and regulations. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities. The Land Use Ordinance Library within the State of Utah Governor's Office of Management and Budget contains the current state-level laws and regulations for land use planning in Utah (State of Utah, 2015b).

Because the Nation's airspace is governed by federal laws, there are no specific Utah state laws that would alter the existing conditions relating to airspace for this PEIS. However, there are state statutes that address the safety of the airspace and flight safety at public airports and obstruction to airspace considerations as addressed in Title 72 of the Utah Code, Transportation Code (Utah State Legislature, 2015a).

16.1.7.3. Land Use and Ownership

For the purposes of this analysis, Utah has been classified into primary land use groups based on coverage type as semi-desert, forest and woodland, shrub and grassland, agriculture, and developed land. Land ownership within Utah has been classified into four main categories: private, federal, state, and tribal.

Land Use

Table 16.1.7-1 identifies the major land uses by coverage type in Utah. Semi-Desert comprises the largest portion of land use with 36.4 percent of Utah's total land area occupied by this category. Forest and Woodland is the second largest area of land use with 29.7 percent of the total land area. Shrub and Grassland areas account for approximately 12.8 percent of the total land area. Agricultural land occupies 4.0 percent, while developed areas account for 1.4 percent of the total land in Utah. The remaining percentage of land includes public land, surface water, and other land covers, shown in Figure 16.1.7-1, that are not associated with specific land uses.

Table 16.1.7-1: Major Land Uses in Utah by Coverage Type

Land Use	Square Miles*	Percent of Land
Semi-Desert	30,921	36.4%
Forest and Woodland	25,217	29.7%
Shrub and Grassland	10,929	12.8%
Agricultural	3,379	4.0%
Developed	1,262	1.4%
Public Land, Surface Water and other Land Covers	13,337	15.7%

Source: (USGS, 2012a)

*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.

Semi-Desert, Shrub, and Grassland

Semi-desert, shrub, and grassland can be found throughout the state, with most of these areas typically at the lower elevations and valleys. The largest, most contiguous concentrations of semi-desert are in the western part of the state (Figure 16.1.7-1). Although these areas are not developed, semi-desert and shrub land sustains multiple uses such as, oil and gas production, recreation, mineral development, rangeland for livestock, scientific study, and preservation of natural resources. Taken together, semi-desert, shrub, and grassland areas account for nearly half (49.2 percent) of the state's land area. More detail on these areas is provided under the Land Ownership heading in this section.

Forest and Woodland

Forest and woodland areas are typically found within the mountainous regions (Rocky Mountains) of the state and along the foothills (Figure 16.1.7-1). Forest and woodlands account for nearly 30 percent (25,217 square miles) of the total land in Utah. These lands serve multiple uses, including the production of forest products, recreation, mineral development, preservation and scientific study. Forested areas are managed by the U.S. Forest Service, the National Park Service (NPS), the State Division of Forestry and Fire, and the Bureau of Land Management (BLM). There are also many privately owned forested areas within the state with uses including vacation homes, camps, commercial uses, recreation, and ranching. Section 16.1.6 presents additional information about terrestrial vegetation.

Agricultural Land

Agricultural land exists in every region of the state, with the largest concentrations in the middle of the state, along the valleys adjacent to the Rocky Mountains (Figure 16.1.7-1). Four percent of Utah's total land area is classified as agricultural land (3,379 square miles). In 2012, there were 18,027 farms in Utah and most were owned and operated by small, family businesses, with the average farm size of less than 100 acres (USDA Census of Agriculture, 2012a). Some of the state's largest agricultural uses include cattle, dairy, hay, hogs, chicken eggs, and wheat (USDA

Census of Agriculture, 2012b). For county-specific information regarding different types of agricultural operations found in the state, access the USDA Census of Agriculture website: http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Utah/.

Developed Land

Developed land in Utah tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 16.1.7-1). Although only 1.4 percent of Utah land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Figure 16.1.7-1 shows where these areas are within the developed land use category. Table 16.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates.

Table 16.1.7-2: Top Five Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Salt Lake City/West Valley City	1,021,243
Ogden/Layton	546,026
Provo/Orem	482,819
St. George	98,370
Logan	94,983
Total Estimated Population of Metropolitan Areas (2012)	**2,243,441**
Total State Estimated Population (2014)	**2,942,902**

Source: (U.S. Census Bureau, 2012)

Land Ownership

Land ownership within Utah has been classified into four main categories: private, federal, state, and tribal (Figure 16.1.7-2).[99]

Private Land

Private land in Utah falls under the land use categories of agricultural, forest and woodland, rangeland, and developed (Figure 16.1.7-1). 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.

[99] 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 data set 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.

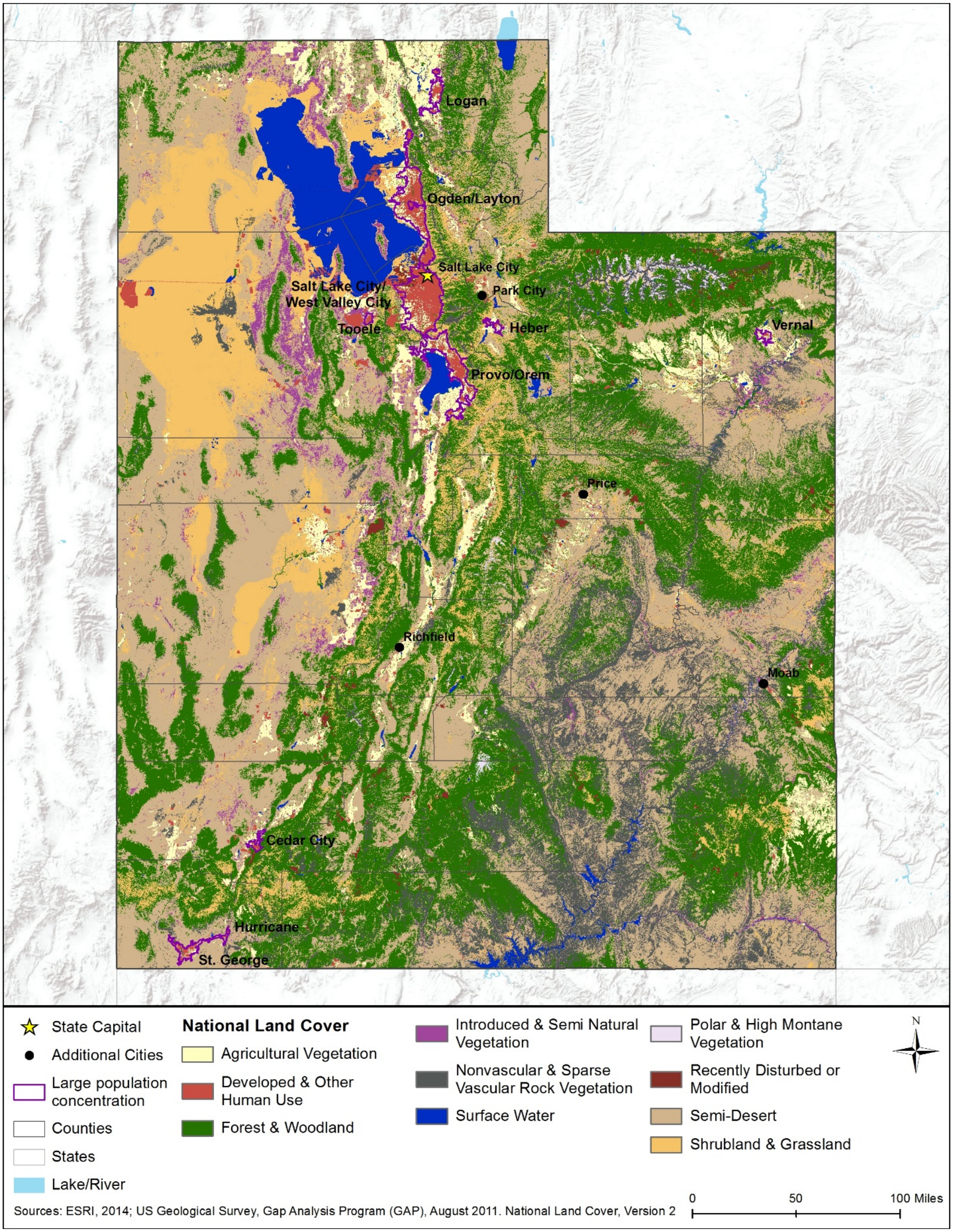

Figure 16.1.7-1: Major Land Use Distribution by Coverage Type

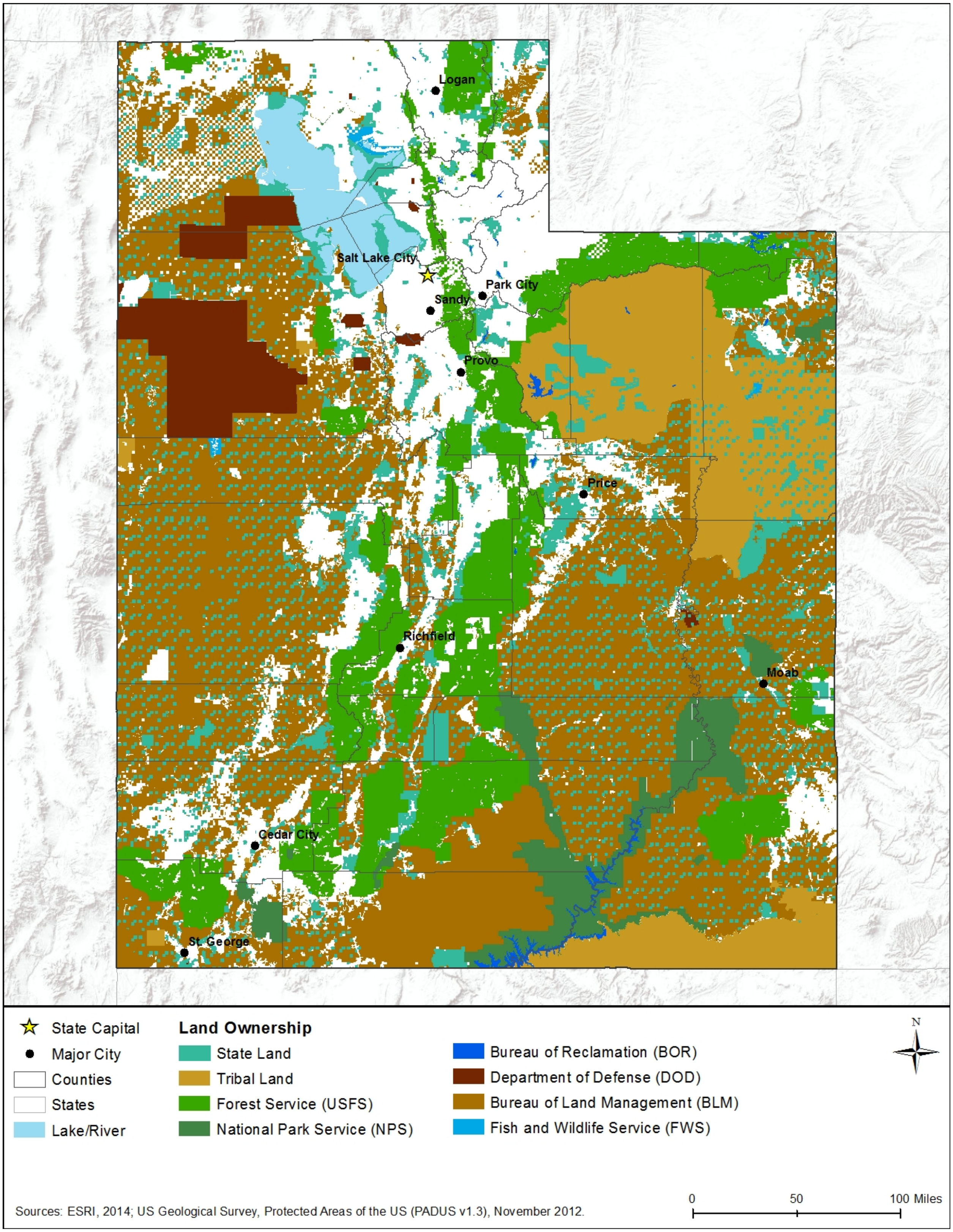

Figure 16.1.7-2: Land Ownership Distribution

Federal Land

The federal government manages 54,899 square miles of Utah land with a variety of land types and uses, including national parks, monuments, historic sites, military bases, and national forests. Six federal agencies manage the majority of federal lands throughout the state (Table 16.1.7-3). There may be other federal lands, but they are not shown on the map due to their small size relative to the entire state. (USGS, 2012a)

Table 16.1.7-3: Federal Land in Utah

Agency[a]	Square Miles	Type
U.S. Fish and Wildlife Service (USFWS)	95	National Wildlife Refuges, Migratory Bird Refuge
Bureau of Reclamation (BOR)	298	Reservoirs
Department of Defense (DOD)	2,875	Air Force Base, Test Center, Ranges
National Park Service (NPS)[b]	3,306	National Parks, Recreation Areas, and Monuments
Forest Service (USFS)	12,604	National Forests, Wilderness Areas
Bureau of Land Management (BLM)	35,721	Forestry, Energy, Recreation, Preservation, Wilderness

Sources: (USGS, 2012a) (USGS, 2003c)
[a] Table identifies land wholly managed by the Agency; additional properties may be managed by or affiliated with the Agency. Bureau of Indian Affairs land included the Tribal Land subsection.
[b] Additional trails and corridors pass through Utah that are part of the National Park System.

- The DOD owns and manages 2,875 square miles used for Hill Air Force Base, Wendover Range, Dugway Proving Grounds, Camp Williams, and the Utah Launch Complex;
- The USFWS owns and manages 95 square miles consisting of the Bear River Migratory Bird Refuge, and the Fish Springs National Wildlife Refuge;
- The USFS owns and manages 12,604 square miles set aside as the Ashley, Caribou-Targhee, Uinta-Wasatch-Cache, Manti-La Sal, Sawtooth, Fishlake, and Dixie National Forests, as well as the Flaming Gorge NRA (within Ashley NF);
- The NPS manages 3,306 square miles consisting of 13 NPS units, including these representative examples: Timpanogos Cave NM, Zion NP, Bryce Canyon NP, Cedar Breaks NM, Arches NP, Canyonlands NP, Capitol Reef NP, Glen Canyon NRA, Dinosaur NM, and Canyonlands NP, Hovenweep NM, Natural Bridges NM, Rainbow Bridge NM, Golden Spike NHS; and
- The BLM owns and manages 35,721 square miles consisting of multiple use lands, wilderness, Areas of Critical Environmental Concern, Grand Staircase-Escalante National Monument, and recreation areas.

State Land[100]

The Utah state government owns approximately 6,332 square miles of land comprised of forests and woodlands, historic sites, state offices, school and institutional trust lands, universities, beds of navigable waters, state parks, range, and recreation areas (Table 16.1.7-4).

[100] 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.

Table 16.1.7-4: State Land in Utah

Agency	Square Miles[a]	Representative Type
School and Institutional Trust Lands Administration	5,312	Natural resources production, recreation, preservation
Division of Parks and Recreation	148	State parks
Division of Wildlife Resources	41	Wildlife management areas
Other	831	Universities, state offices, historic sites

Source: (USGS, 2012a)
[a] Acres are not additive due to overlapping boundaries of the State Forests, State Parks and Recreation Areas, and Wildlife Management Areas

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

- The Utah School and Institutional Trust Lands Administration manages 5,312 square miles of land set aside to produce revenue for state education purposes.
- The Utah Division of Parks and Recreation manages 43 state parks encompassing 148 square miles. The parks are throughout the state and include heritage sites, lakes, campgrounds, forests, and other recreational and preservation areas.
- The Utah Division of Wildlife Resources owns and manages 33 wildlife management areas, encompassing 41 square miles.

Tribal Land

Tribal land in Utah consists of 9,192 square miles, or just over 11 percent of the total land within Utah (USGS, 2012a) (USGS, 2014h).[101] These lands are composed of 11 Reservations throughout the state (Table 16.1.7-5). For additional information regarding tribal land, see Section 16.1.11, Cultural Resources.

Table 16.1.7-5: Indian Reservations and Other Land Holdings of Utah

Reservation Name	Square Miles
Paiute Indian Tribe Cedar Band	3.7
Confederated Tribes of the Goshute Reservation	60.8
Paiute Indian Tribe Indian Peaks Band	0.1
Paiute Indian Tribe Kanosh Band	3.1
Paiute Indian Tribe Koosharem Band	1.1
Navajo Nation	2,005.0
Northwestern Shoshoni Indian Reservation	0.30
Paiute Indian Tribe Shivwits Band	43.0
Paiute Indian Tribe	0.7
Skull Valley Indian Reservation	29.9
Ute Indian Tribe of the Uintah and Ouray Reservation	7,023.0

[101] 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.

Reservation Name	Square Miles
Ute Mountain Ute Indian Reservation	22.0
Total	**9,192.0**

Sources: (USGS, 2012a) (USGS, 2014h)

16.1.7.4. Recreation

Utah terrain is dominated by the Wasatch Range and Uinta Mountains centrally from north to south with plateaus, cliffs, and canyons running parallel to the east and vast expanses of desert running parallel to the west. The state has an abundance of highly visited natural areas, most notably Timpanogos Cave NM, Zion NP, Bryce Canyon NP, Cedar Breaks NM, Arches NP, Canyonlands NP, Capitol Reef NP, Glen Canyon NRA, Dinosaur NM, Canyonlands NP, Hovenweep NM, Natural Bridges NM, Rainbow Bridge NM, Golden Spike NHS, Grand Staircase-Escalante NM, and Glen Canyon NRA. Tourism is a major industry centered on those parks and natural areas, Monument Valley, world-class ski resorts, Moab's rock climbing and mountain biking routes, and American Indian and Mormon cultural/heritage sites. Major water features that provide a wide variety of recreational opportunities include the Great Salt, Utah, and Bear Lakes, the Green and Colorado Rivers, and many reservoirs, mountain streams, and lakes. (Utah Office of Tourism, 2016a)

On the community level, cities and towns provide an assortment of indoor and outdoor recreational facilities including: community and recreation centers, theaters, museums, athletic fields and courts, golf courses, multi-use trails, playgrounds, picnicking areas, theme/amusement parks, alpine (downhill) ski resorts and Nordic (cross country skiing) centers, and boat launches and marinas. Availability of community-level facilities is typically commensurate to the population's distribution and interests, and the natural resources prominent in the vicinity. There are 43 state parks (Utah Department of Natural Resources - State Parks Office, 2015).

Federally, the BLM, NPS, USFS, and the USFWS manage areas in Utah with substantial recreational attributes (Figure 16.1.7-3).[102] Almost 36,000 square miles of public land in Utah (42 percent of the state land base) is under the administration of the BLM (BLM, 2015e).

This section discusses key recreational opportunities and activities representative of various regions of Utah. The state can be categorized by three distinct recreational regions, each of which are presented in the following sub-sections. For information on visual resources such as National Scenic Byways and state-designated Byways, see Section 16.1.8, 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 16.1.11, Cultural Resources.

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[102] 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.

Eastern Region

Utah's Eastern Region can be roughly defined as the area east of the Wasatch Range and bordered by the states of Wyoming, Colorado, and Arizona (Figure 16.1.7-3). The Uintah and Ouray Indian Reservation dominates the northern half of this region. Just over one quarter of total reservation land area is tribally-owned, the rest includes private holdings, the High Uintas Wilderness Area, and portions of the Wasatch-Cache, Uinta, and Ashley National Forests. Flaming Gorge National Recreation Area (within Ashley NF) and Dinosaur National Monument (shared with Wyoming and Colorado, respectively) are highly visited sites in the northern part of this region. The Green River flows from Flaming Gorge through Desolation and Gray Canyons, before joining the Colorado River in the southern half of this region. The Colorado flows onward through Cataract and Glen Canyons, and Lake Powell before entering the Grand Canyon. This river system running the entire length of eastern Utah is renowned for its appeal to canoers, kayakers, rafters, pontoon boaters, power boaters, and fishermen. The southern portion of this region is a landscape filled with plateaus, cliffs, desert valleys, river canyons, the La Sal Mountains, and the Manti-La Sal National Forest. Favorite tourist destinations are Arches and Canyonlands National Parks, Glen Canyon National Recreation Area, Natural Bridges and Hovenweep National Monuments, Monument Valley, Four Corners, and Moab. In addition to the many water sports opportunities, sightseeing, hiking, canyoneering, rock climbing, biking, 4-wheeling, and skiing are popular recreation activities. (Utah Office of Tourism, 2016b)

Central Region

The northern portion of the Central Region is Utah's most densely populated area. The major cities of Logan, Ogden, Salt Lake City, Provo, and the smaller cities and towns surrounding them, make an almost continuous 100-mile metropolitan zone along Interstate 15. To the east of this corridor are the Wasatch Range, and the Wasatch-Cache and Uinta National Forests; and to the west is the Great Salt Lake and Utah Lake (Figure 16.1.7-3). The Wasatch Range receives over 500 inches of powder snow annually, supporting 11 ski resorts within an hour of Salt Lake City (Utah Office of Tourism, 2016e) (Ski Utah, 2016a). Ogden's Powder Mountain and Snow Basin Resorts; Salt Lake City's Alta and Snowbird Resorts; Park City's Mountain, Canyon, and Deer Valley Resorts; and Provo's Sundance Resort are best known. (Ski Utah, 2016b) The Cache Valley and nearby Bear Lake are popular for camping, boating, fishing, hiking and snow sports. Salt Lake City is flanked by mountains and the Great Salt Lake that provide diverse options for all types of outdoor recreation. Within the city, venues for concerts, performing arts, and sports events are plentiful, as well as museums and the Mormon Temple Square historical sites. Provo's two universities provide cultural, artistic, and sporting events to its residents and visitors. Utah Lake provides opportunities for all types of water-based recreation. (Utah Office of Tourism, 2016c) (Utah Office of Tourism, 2016d)

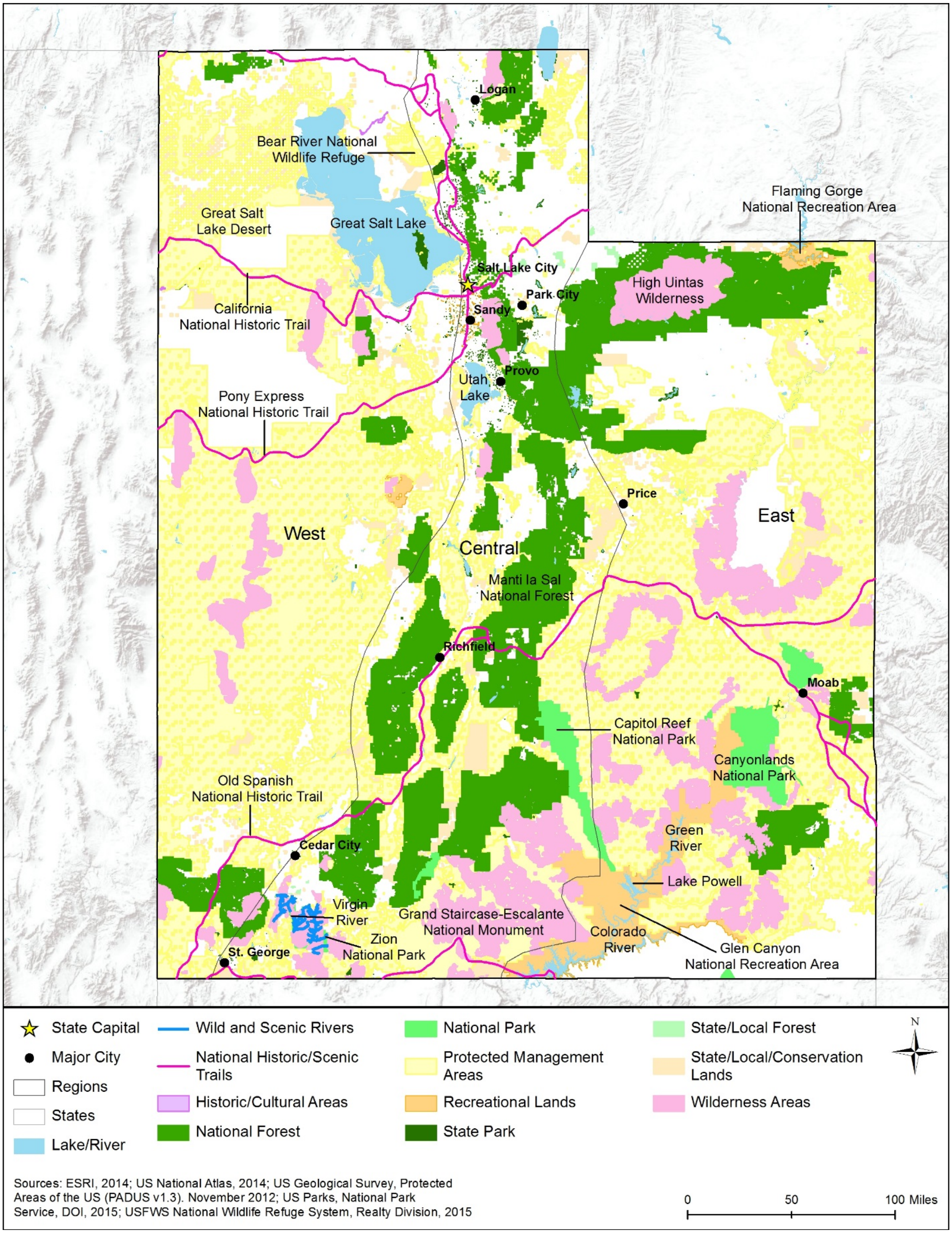

Figure 16.1.7-3: Utah Recreation Resources

The southern portion of the Central Region is almost completely filled with National Forest lands (Uinta, Manti-La Sal, Fishlake, and Dixie). State Parks, reservoirs, and mountains are in an abundance, providing opportunities for all types of outdoor recreation activities. Capitol Reef National Park's 100-mile geologic fold has rich geology, cultural and historical sites, amid scenic beauty. The Grand Staircase-Escalante National Monument's expansive 1.9 million acres is explored by hikers, bikers, 4-wheelers, campers, fishermen, horseback riders, photographers, and geology, fossil, and ancient culture aficionados (Utah Office of Tourism, 2016b).

Western Region

Utah's Western Region can be roughly defined as the area west of the Wasatch Range and bordered by the states of Idaho, Nevada and Arizona (Figure 16.1.7-3). This region of the state is sparsely populated, largely due to the presence of the Great Salt Lake, Great Salt Lake Desert, Sevier Desert, and the large tracts of military testing and training lands with no public access. The exception is the St. George area in the southwest corner of the state that has made the Census Bureau's list of fastest growing U.S. cities in several reporting periods (U.S. Census Bureau, 2015x). Proximity to Zion and Bryce Canyon National Parks, Arizona's Grand Canyon and Vermillion Cliffs, and Nevada's Las Vegas and Lake Mead draws numerous visitors to this region (Utah Office of Tourism, 2016b). The Dixie National Forest has 83,000 acres of wilderness areas, streams, lakes, and reservoirs, as well as developed campgrounds, multi-use trails, and resort lodging. Camping, hiking, canyoneering, skiing, ORV, snowmobile, and horse riding, biking, boating, fishing, hunting, and sight-seeing are popular recreational activities (U.S. Department of Agriculture-Forest Service, 2015). St. George hosts artisans, triathlon, marathon, and mountain biking athletes, and has several world-class destination spas and 10 golf courses. This area has a variety of performing arts theaters, the Tuacahn Amphitheater, playhouses, galleries, and historical, paleontological, art, and wildlife museums (St. George Area Tourism Office, 2015).

16.1.7.5. Airspace

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

Airspace Categories

There are two categories of airspace or airspace areas:

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

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 16.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[103] service is based on the airspace classification (FAA, 2008).

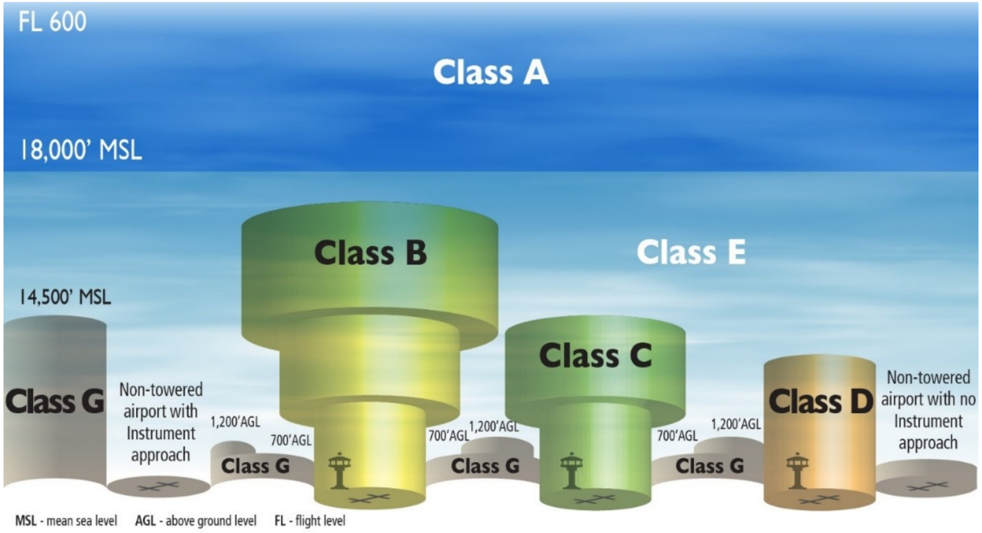

Figure 16.1.7-4: National Air Space Classification Profile

Source: Derived from (FAA, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[104]. 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).[105]
- **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.

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

- **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 16.1.7-6).

Table 16.1.7-6: SUA Designations

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

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

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

Other Airspace Areas

Other airspace areas, explained in Table 16.1.7-7, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 16.1.7-7: Other Airspace Designations

Type	Definition
Airport Advisory	There are three types: • Local Airport Advisory – Operated within 10 statute (5,280 feet/mile) miles of an airport where there is a Flight Service Station (FSS) at 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, 2015a) (FAA, 2008)

16.1.7.6. Aerial System Considerations

Unmanned Aerial Systems

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

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

Balloons

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

16.1.7.7. 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 above ground level; or

- 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; or
- Any highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards; or
- When requested by the FAA; or
- Any construction or alteration at 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.

16.1.7.8. Utah Airspace

The Utah Division of Aeronautics (AERO) is under the jurisdiction of the Utah Department of Transportation (UDOT). The aeronautics division is primarily focused on administering funding for public-use airport projects (construction and maintenance) and operation of state owned aircraft to provide transportation to state employees and elected officials. Their stated mission is to "Promote and foster aviation in Utah by providing safe and functional airport systems as an integral part of the statewide transportation program. Supply safe and efficient air transportation to state agencies and those conducting state business. Provide quality maintenance for state-owned aircraft. Be team oriented and sensitive to the needs of each individual in the organization and customers" (UDOT, 2015d). There is one FAA FSDO for Utah in Salt Lake City (FAA, 2015d).

Utah 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 (National Association of State Aviation Officials (NASAO), 2015). Figure 16.1.7-5 presents the different aviation airports/facilities residing in Utah, while Figure 16.1.7-6 and Figure 16.1.7-7 present a breakout by public and private airports/facilities. There are approximately 153 airports/facilities in Utah (Table 16.1.7-8) (FAA, 2016b).

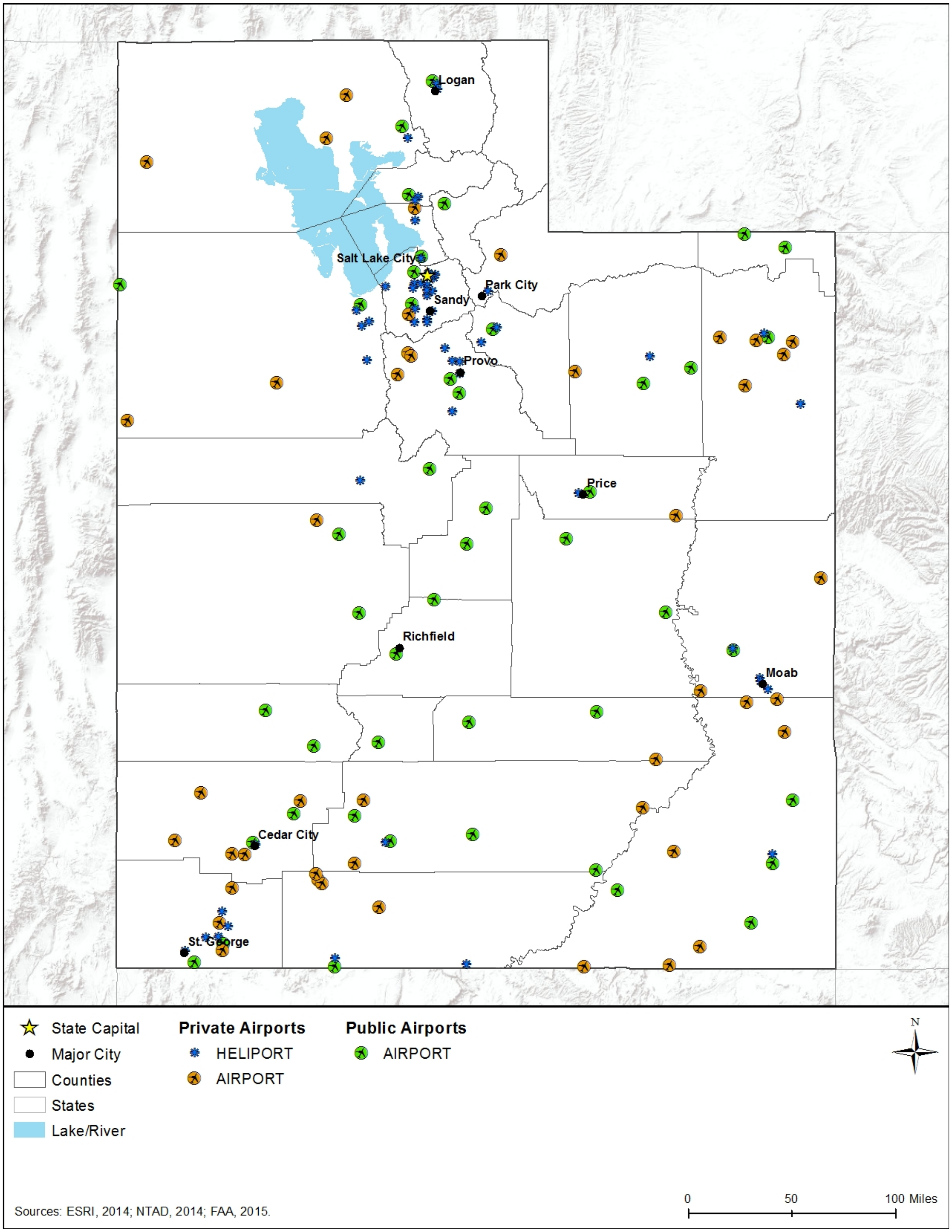

Figure 16.1.7-5: Composite of Utah Airports/Facilities

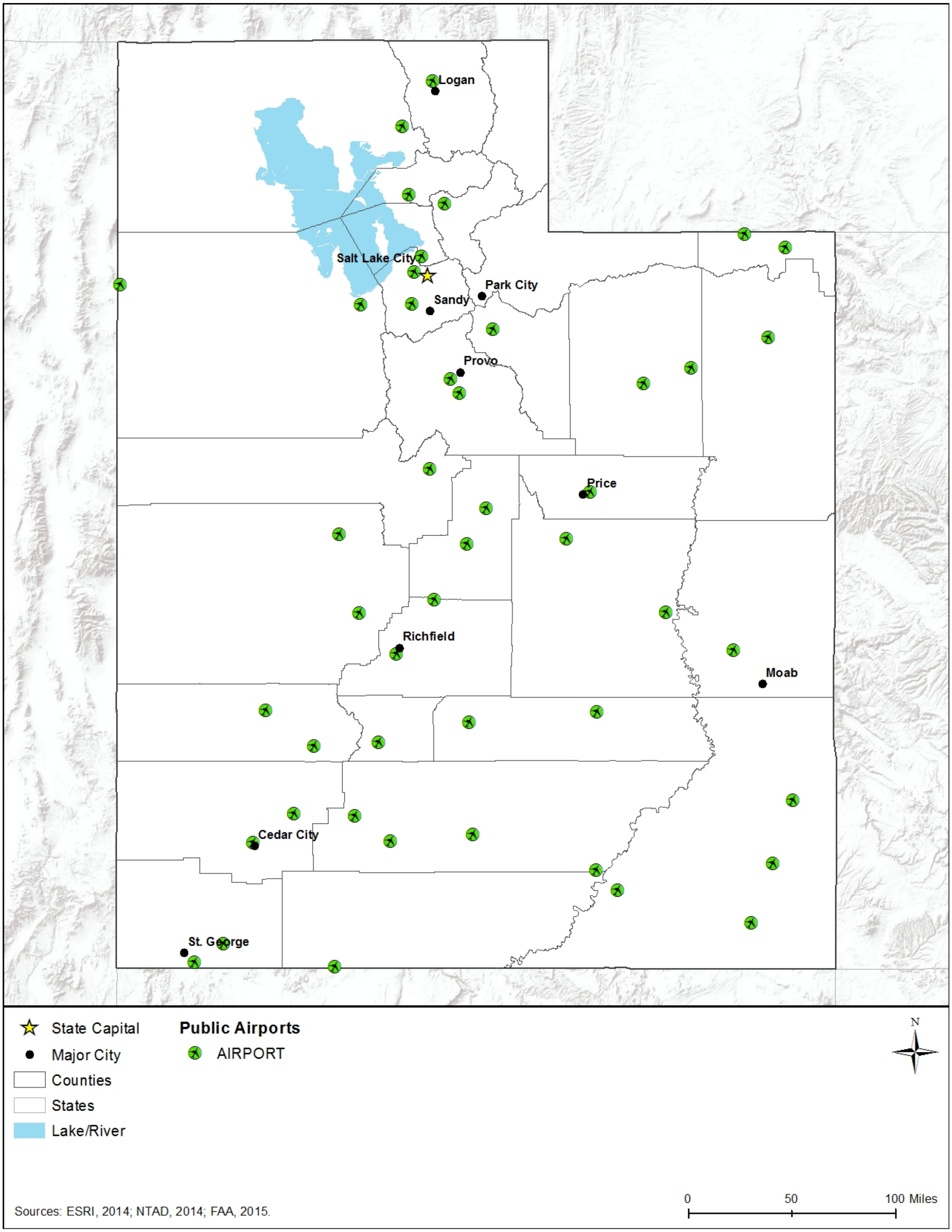

Figure 16.1.7-6: Public Utah Airports/Facilities

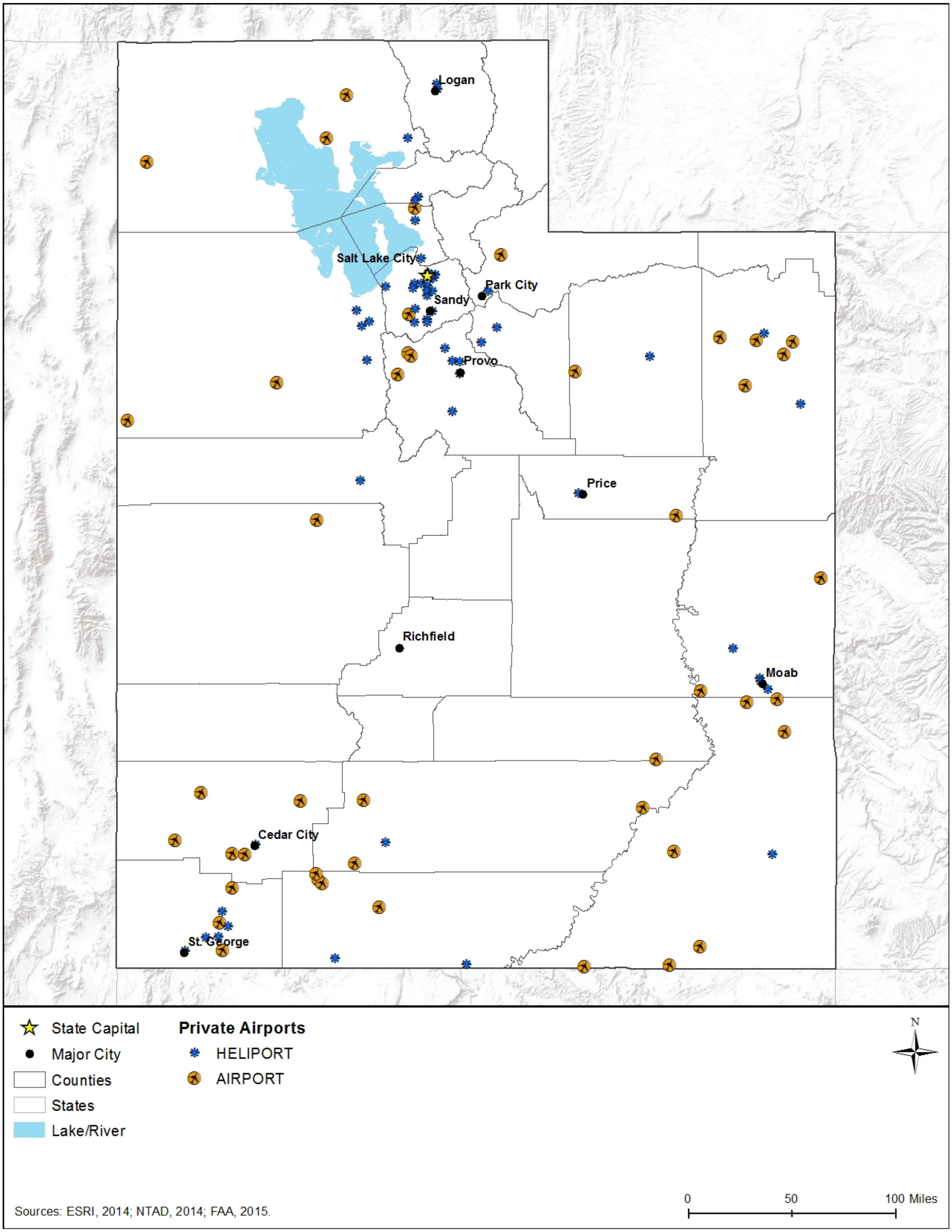

Figure 16.1.7-7: Private Utah Airports/Facilities

Table 16.1.7-8: Type and Number of Utah Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	46	44
Heliport	0	58
Seaplane	0	0
Ultralight	0	0
Balloonport	0	0
Gliderport	0	0
Total	**46**	**102**

Source: (FAA, 2016b)

There are Class B and D controlled airports in Utah as follows:

- One Class B –
  - Salt Lake City International
- Three Class D –
  - Hill AFB
  - Ogden-Hinckley, Ogden
  - Provo Municipal Provo (FAA, 2015f)

SUAs (i.e., 16 restricted areas and 8 MOAs) in Utah are as follows:

- Dugway –
  - R-6402A – Surface to FL 580
  - R-6402B – 100 feet AGL to FL 580
- Tooele –
  - R-6403 – Surface to 9,000 feet MSL
- Hill AFB –
  - R-6404A – Surface to FL 580
  - R-6404B – Surface to 13,000 feet MSL
  - R-6404C – 100 feet AGL to FL 280
  - R-6404D – 13,000 feet MSL to FL 250
  - R-6407 – Surface to FL 580
- Wendover
  - R-6405 – 100 feet AGL to FL 580
  - R-6406A – Surface to FL 580,
  - R-6406B – 100 feet AGL to FL 580
- Camp Williams
  - R-6412A – Surface to 9,000 feet MSL
  - R-6412B – 9,000 feet to 10,000 feet MSL
  - R-6412C – Surface to 9,000 feet MSL
  - R-6412D – 9,000 feet to 10,000 feet MSL

- Green River
  - R-6413 – Surface to unlimited

The eight MOAs for Utah are as follows:

- Gandy –
  - 100 feet AGL to, but not including, FL 180
- Lucin –
  - A – 100 feet AGL to 9,000 feet MSL
  - B – 100 feet AGL to 7,500 feet MSL
  - C – 100 feet AGL to 6,500 feet MSL
- Sevier –
  - A – 100 feet AGL to 14,500 feet MSL
  - B – 100 feet AGL to 9,500 feet MSL
  - C – 14,500 feet MSL to, but not including, FL 180
  - D – 9,500 feet MSL to, but not including, FL 180 (FAA, 2015g)

The Desert MOA (100 feet AGL to, but not including FL 180; excluding the airspace 1,500 feet AGL and below within a 3 NM radius of the Alamo and Lincoln County Airports) of Nevada extends into the southwest portion of Utah around St. George and Cedar City. The Utah SUAs are presented in Figure 16.1.7-8. There are no TFRs (FAA, 2015b); however, there is a National Security Area (NSA 0002)[106] west of Provo, and south of Salt Lake City and Sandy (see Figure 16.1.7-8). The restrictions associated with this NSA may impact airspace in the area. MTRs in Utah, presented in Figure 16.1.7-9, consist of nine Visual Routes and ten Instrument Routes.

[106] National Security Area (NSA) consists of defined vertical and lateral dimensions in the airspace where there is increased security of ground facilities. Pilots are expected to voluntarily avoid flying through the NSA. Additional security levels may result in further restrictions of the NSA, which FAA Headquarters would issue and disseminate with a NOTAM (FAA, 2011).

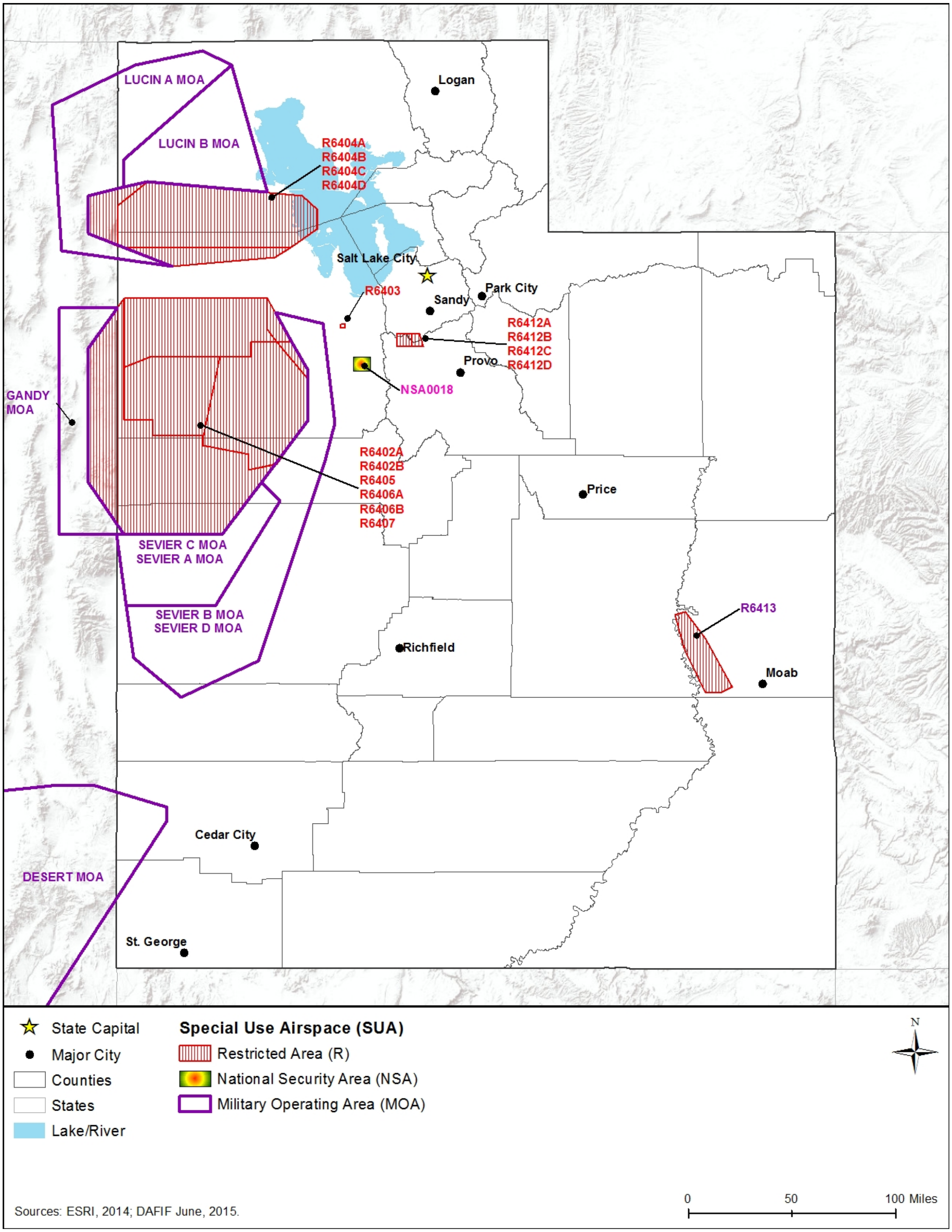

Figure 16.1.7-8: SUAs in Utah

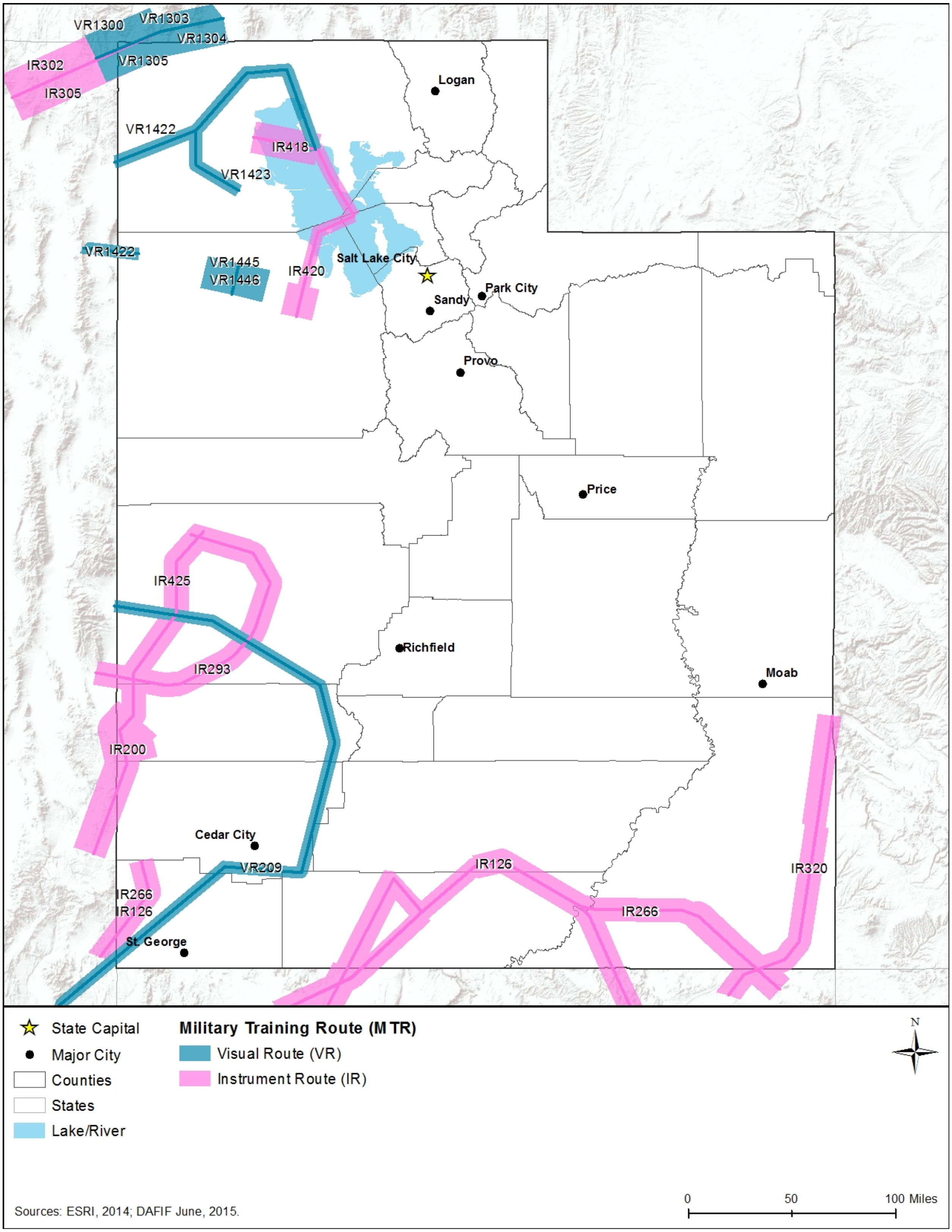

Figure 16.1.7-9: MTRs in Utah

UAS Considerations

The National Park Service (NPS) signed a policy memorandum on June 20, 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 13 National Park Service units[107] in Utah, and other affiliated sites managed by the NPS, that have to comply with this agency directive (NPS, 2015b).

Obstructions to Airspace Considerations

Several references in the Utah Code address airspace hazards. As defined in the Airport Zoning Act (Title 72, Chapter 10, Aeronautics Act, Section 401), an airport hazard is "any structure or tree or use of land which obstructs the airspace required for the flight of aircraft in landing or taking-off at an airport or is otherwise hazardous to the landing or taking-off of aircraft" (Utah State Legislature, 1998). Utah Code, Airport Zoning Act, regulate structures as it obtains to potential impacts to navigable airspace. Section 402 of the act is to assure unobstructed conditions for safe flight within the air traffic pattern of a public airport. (Utah State Legislature, 2015b)

16.1.8. Visual Resources

16.1.8.1. 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 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).

16.1.8.2. Specific Regulatory Considerations

Table 16.1.8-1 presents state and local laws and regulations that relate to visual resources.

[107] This count is based on the NPS website "by the numbers" current as of 9/30/2014 (NPS, 2015j). This number includes all NPS affiliated areas and may vary here depending on when areas are designated by Congress.

Table 16.1.8-1: Relevant Utah Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Utah Code, Title 72, Chapter 4, Part 3 – Utah Scenic Byway Program	Utah State Scenic Byway Committee	Provides for the designation of state scenic byways.
Utah Code, Title 9, Chapter 8, Part 4 – Historic Sites	Department of Heritage Arts and Culture	Provides for the preservation of historic sites stating, "the public has a vital interest in all antiquities, historic and prehistoric ruins, and historic sites, buildings, and objects which, when neglected, desecrated, destroyed or diminished in aesthetic value, result in an irreplaceable loss to the people of this state."
Utah Code, Title 69, Chapter 3, Section 1 – Authority to Acquire Sites	Various state and local agencies and municipalities	"The state, counties, cities, and towns may create or acquire sites to accommodate the erection of telecommunication towers and related facilities. Title to these sites shall be retained by the state, county, city, or town acquiring such sites in order to promote the location of such towers in a manageable area and to protect the aesthetics and environment of the area."
Utah Code, Title 10, Chapter 9a – Municipal Land Use, Development, and Management Act	Various state and local agencies and municipalities	Requires municipalities to prepare and adopt a general plan. "The plan may provide for: (a) health, general welfare, safety, energy conservation, transportation, prosperity, civic activities, aesthetics, and recreational, educational, and cultural opportunities."

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

16.1.8.3. Character and Visual Quality of the Existing Landscape

Utah has a wide range of visual resources. The most prevalent visual resources within Utah are within natural areas, including mountains and forests, agricultural areas, desert and slick rock areas, lakes and rivers, and natural geological features and formations. Visual resources within natural areas are generally comprised of continuous, natural looking cover with gradual transitions of line and color. They are typically characterized by the lack of disturbance or disruption of the landscape. Lakes, rivers, wetlands, and waterfront lands in Utah vary from vegetated riparian areas (areas on the bank of a watercourse or lake) to wide, open lakeside vistas. The consistency, continuity, and lack of view obstructions from major constructed features characterizes the visual attributes of these areas.

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

16.1.8.4. 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 16.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Utah, there are 1,818 NRHP listed sites, which include 2 National Heritage Areas, 14 National Historic Landmarks, and 1 National Historical Site (NPS, 2016a). 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).

National Heritage Areas

National Heritage Areas (NHAs) are "places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape" (NPS, 2011). These areas help tell the history of the United States. Based on this criteria, NHAs in Utah may contain scenic or aesthetic areas considered visual resources or visually sensitive. There are two NHAs in Utah: the Mormon Pioneer NHA and the Great Basin National Heritage Route (NPS, 2012a) (Figure 16.1.8-1).

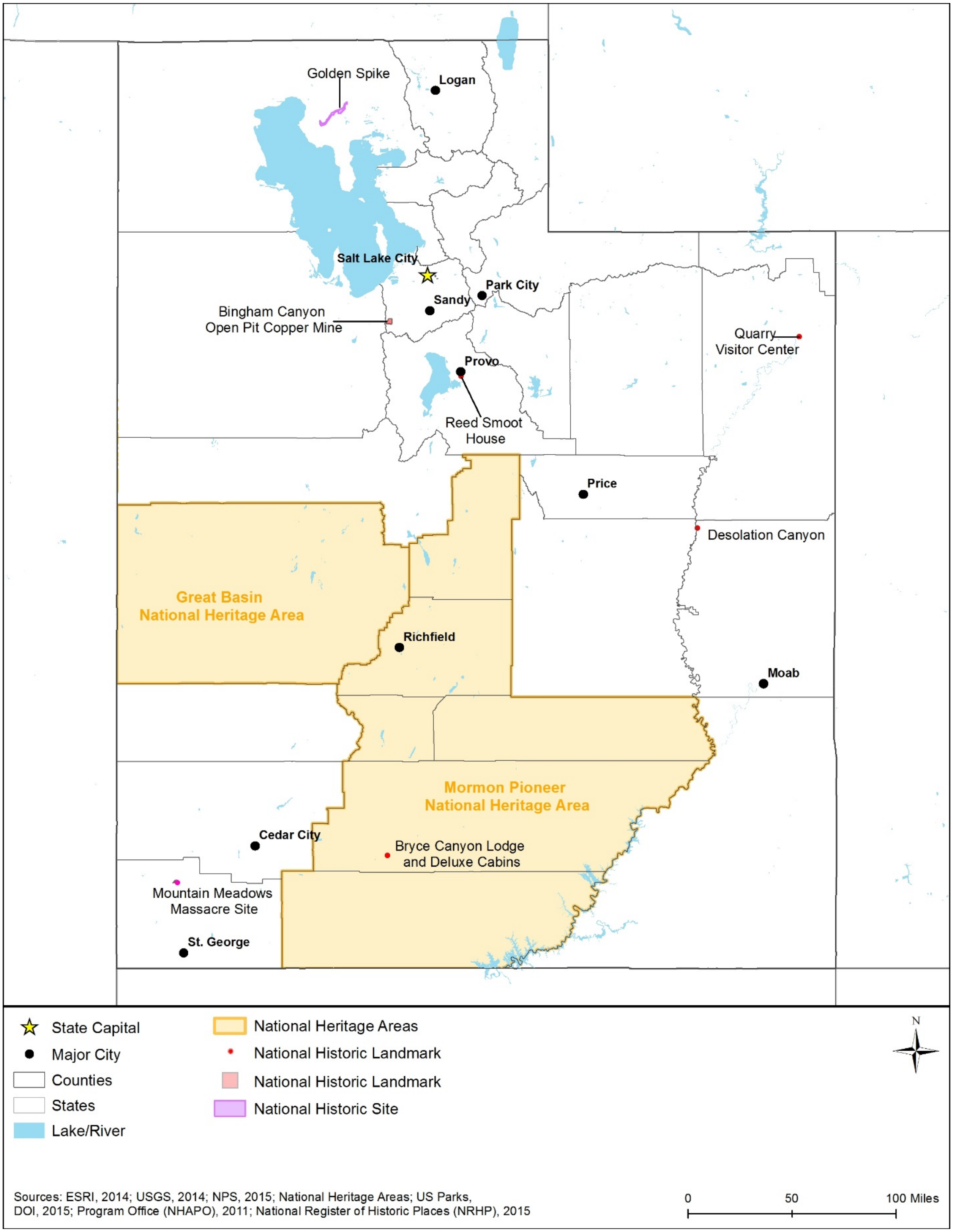

Figure 16.1.8-1: Representative Sample of Some Cultural and Heritage Resources that May be Visually Sensitive

National Historic Landmarks

National Historic Landmarks (NHLs) are defined as "nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States" (NPS, 2015m). Generally, NHLs may include "historic buildings, sites, structures, objects, and districts" (NPS, 2016b). Other types of historic properties include battlefields and canals. The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities, among other attributes, that may be considered visual resources or visually sensitive at these sites. In Utah, there are 14 NHLs (Figure 16.1.8-1) (NPS, 2015d):

- Alkali Ridge,
- Bingham Canyon Open Pit Copper Mine,
- Bryce Canyon Lodge and Deluxe Cabins,
- Central Utah Relocation Center (Topaz),
- Danger Cave,
- Desolation Canyon,
- Emigration Canyon,
- Fort Douglas,
- Mountain Meadows Massacre Site,
- Old City Hall,
- Quarry Visitor Center,
- Reed O. Smoot House,
- Temple Square, and
- Brigham Young Complex.

By comparison, there are over 2,500 NHLs in the United States (NPS, 2015l). Figure 16.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive.

Historic Properties of Utah

The Utah Register of Historic Sites and the Century Register of Historic Places in Utah were established in 1988 to preserve sites with special historical importance to Utah. Utah currently uses the Historic Building Database to catalog historic sites in Utah. The database contains both national and state sites and can be accessed via the Utah Division of State History website. In addition to historic sites, there are a number of historic districts in Utah having "a concentration of historic buildings (50 years or older)" (Utah Division of State History, 2013). State historic sites and places are likely to contain scenic or aesthetic components that may be considered visual resources or visually sensitive. For additional information regarding these properties and resources, see Section 16.1.11, Cultural Resources.

16.1.8.5. 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 16.1.8-3 identifies parks and recreational resources that may be visually sensitive in Utah.[108] For additional information about recreation areas, including national and state parks, see Section 16.1.7, Land Use, Recreation, and Airspace.

State Parks

State parks contain natural, historic, cultural, and/or recreational resources of significance to Utah residents and visitors. There are 43 state parks throughout Utah, such as Antelope Island State Park (Figure 16.1.8-2), most of which contain scenic or aesthetic areas considered to be visual resources or visually sensitive (Utah State Parks Office, 2015). Table 16.1.8-2 contains a sampling of state parks and their associated visual attributes. For a complete list of state parks, visit the Utah State Parks website (Utah State Parks Office, 2015).

Figure 16.1.8-2: Antelope Island State Park

Source: (Utah State Parks, 2015)

[108] 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.

Table 16.1.8-2: Examples of Utah State Parks and Associated Visual Attributes

State Park	Visual Attributes
Antelope Island	Views of the Great Salt Lake, wildlife viewing, scenic vistas with rocky outcroppings
Dead Horse Point	Views of the Colorado River, vertical cliffs and canyons, slick rock and desert
Scofield	Views of mountains, valleys, lake, stream, and forest
This is the Place	Historical sites
Coral Pink Sand Dunes	Views of rolling desert hills of red sand and mountains
Escalante Petrified Forest	Views of Wide Hollow Reservoir, petrified forest, petrified wood, scenic desert vistas

Source: (Utah State Parks Office, 2015)

National Park Service

National Parks are managed by the NPS and contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation and are maintained for the public's use. In Utah, there are 13[109] officially designated National Parks Service units. The NPS manages five National Parks, 6 National Monuments, one National Recreation Area, and one Historic Site (see Figure 16.1.8-3) (NPS, 2015e). Table 16.1.8-3 identifies the National Parks and affiliated areas in Utah. For additional information regarding parks and recreation areas, see Section 16.1.7, Land Use, Recreation, and Airspace.

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

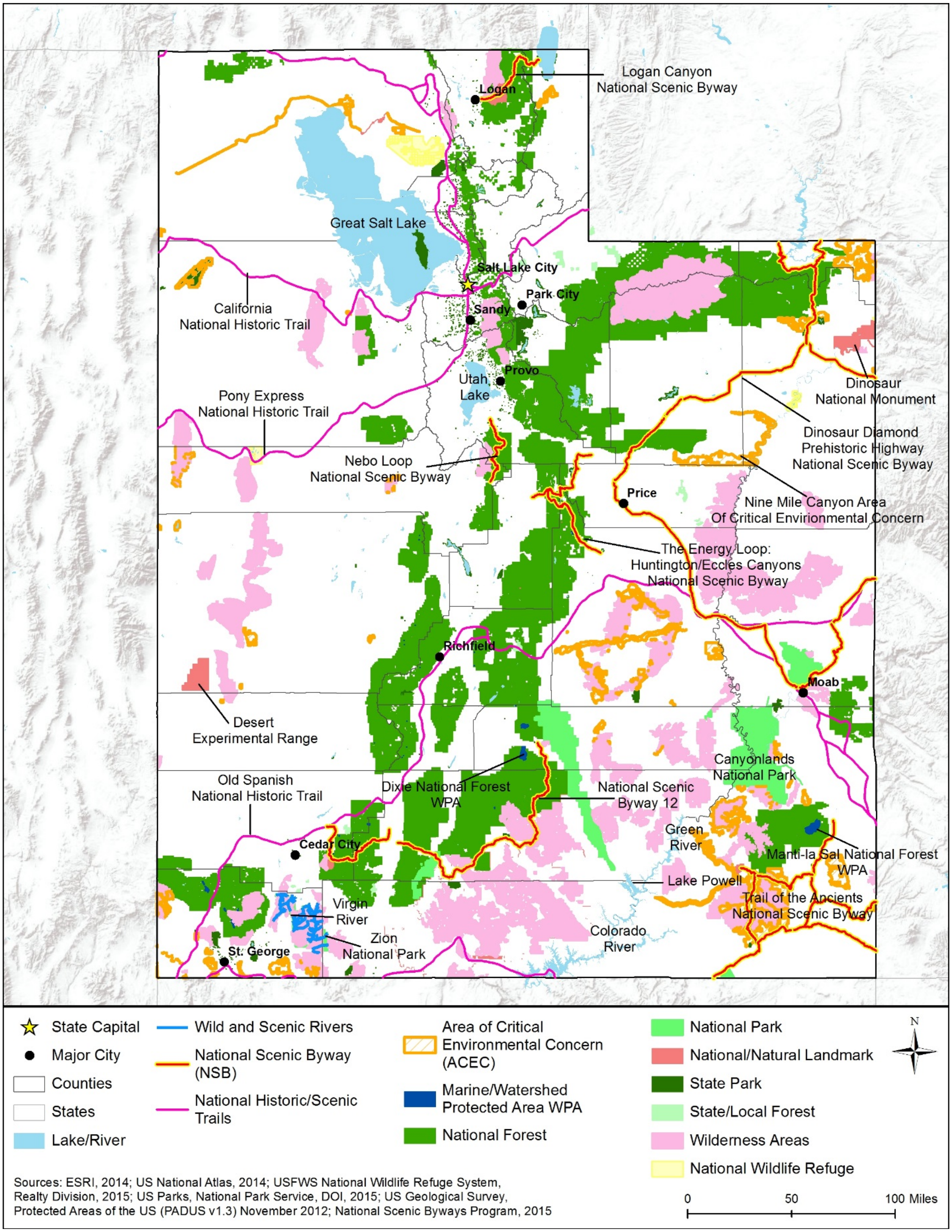

Figure 16.1.8-3: Natural Areas that May be Visually Sensitive

Table 16.1.8-3: Utah National Park Service Units

Area Name	
Arches National Park	Bryce Canyon National Park
Canyonlands National Park	Capitol Reef National Park
Cedar Breaks National Monument	Dinosaur National Monument
Glen Canyon National Recreation Area	Golden Spike Historic Site
Hovenweep National Monument	Natural Bridges National Monument
Rainbow Bridge National Monument	Timpanogos Cave National Monument
Zion National Park	

Source: (NPS, 2015f)

National Forests

The U.S. Forest Service (USFS) manages National Forests that may contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation. In Utah, there are seven National Forests (USFS, 2016a):

- Ashley NF,
- Caribou-Targhee NF,
- Dixie NF,
- Fishlake NF,
- Manti-La-Sal NF,
- Sawtooth NF, and
- Uinta-Wasatch-Cache NF (Figure 16.1.8-3).

For additional information regarding parks and recreation areas, see Section 16.1.7, Land Use, Recreation, and Airspace.

Figure 16.1.8-4: Uinta-Wasatch-Cache National Forest

Source: (USFS, 2016b)

Federal and State Trails

Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Scenic Trails (NSTs) are defined as extended trails that "provide for maximum outdoor recreation potential, and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which" they pass (BLM, 2012). There are four National Historic Trails within Utah:

- California Historic Trail (1,000 miles across 10 states),
- Mormon Pioneer Historic Trail (1,300 miles across five states),
- Old Spanish Historic Trail (2,700 miles across six states), and
- Pony Express Historic Trail (1,800 miles across eight states) (NPS, 2015f).

In addition to National Scenic Trails, the National Trails System Act authorized the designation of National Recreational Trails (NRTs) near urban areas by either the Secretaries of the Interior or Agriculture, depending upon the ownership of the designated land (American Trails, 2015a). In Utah, there are 19 designated NRTs (Table 16.1.8-4) (American Trails, 2015b).

Table 16.1.8-4: National Recreational Trails in Utah

Bald Mountain	Left Fork Huntington Creek
Bicentennial	Little Hole
Cascade Falls	Moab Slickrock Bike Trail
Cascade Springs	Mount Timpanogos Trail
Fish Creek (Ashley NF)	Naomi Peak
Fish Creek (Manti-La Sal NF)	Red Canyon Trail
Fisher Towers Trail	Skyline
Gooseberry Mesa Trail	Wetland Wonders Walk
Historic Union Pacific Rail Trail	Whipple
Lakeshore – Utah	

Source: (American Trails, 2015b)

State designated trails are within state parks and other state-owned land. These trails include hiking and backpacking trails, off-highway vehicle trails, and bike trails. These trails contain visual resources such as historic views, forest and woodland views, and scenic vistas of valleys and gorges.

16.1.8.6. Natural Areas

National Wilderness Areas

In 1964, Congress enacted the Wilderness Act of 1964 as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain" (Wilderness.net, 2016a). 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" (Wilderness.net, 2016a). Over 106 million acres of federal public lands have been designated as wilderness areas in the United States. Twenty-five percent of these federal lands are in 47 national parks (44 million acres) and part of National Park System. These designated wilderness areas are managed by the U.S. Forest Service, Bureau of Land Management (BLM), U.S. Fish and Wildlife Service, and NPS (NPS, 2015g). Utah is home to 33 federally managed Wilderness Areas covering 1,157,680 acres (approximately one percent of total wilderness in the U.S.) (Figure 16.1.8-3) (NPS, 2015g) (Wilderness.net, 2015b) (Wilderness.net, 2016c).

National Monument

BLM manages Utah's newest National Monument, the Grand Staircase-Escalante National Monument (GSENM), established by Presidential Proclamation in 1996. The GSENM consists of approximately 1.7 million acres of federal land in southeastern Utah. The monument contains geologic, paleontological, archaeological, and biological characteristics. The area contains features, sites, and structures of scientific and historic value (President of the United States of America, 1996). Additionally, there are six NPS-managed National Monuments in Utah (Cedar Breaks, Dinosaur, Hovenweep, Natural Bridges, Rainbow Bridge, and Timpanogos).

Rivers Designated as National or State Wild, Scenic or Recreational

National Wild, Scenic, or Recreational Rivers are those rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271-1287). These rivers have outstanding natural, cultural, and recreational values, including potential visual resources. A portion (169.3 miles) of one river, the Virgin River, has been designated a National Wild and Scenic River in Utah (Figure 16.1.8-3) (National Wild and Scenic Rivers System, 2016).

National Wildlife Refuges

National Wildlife Refuges (NWRs) are a network of lands and waters managed by the USFWS. These lands and waters are set aside "for the conservation, management and, where appropriate, restoration of fish, wildlife, and plant resources and their habitats" (USFWS, 2015y). There are three NWRs in Utah:

Figure 16.1.8-5: Bear River National Wildlife Refuge

Source: (USFWS, 2015x)

- Bear River NWR (nearly 80,000 acres) (Figure 16.1.8-5), (USFWS, 2016c)
- Fish Springs NWR (17,992 acres), (USFWS, 2016d) and

- Ouray NWR (11,987 acres) (Recreation.gov, 2014).

Visual resources within the NWRs include views and sites of the Great Salt Lake, wetlands, migratory birds, rivers, and scenic valleys and meadows.

National Natural Landmarks

NNLs are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and geological resources, regardless of land ownership…" and "…are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (NPS, 2014d). These landmarks may be considered visual resources or visually sensitive. In Utah, four NNLs exist entirely or partially within the state:

- Neffs Canyon Cave,
- Cleveland-Lloyd Dinosaur Quarry,
- Little Rockies (Figure 16.1.8-6), and
- Joshua Tree Natural Area.

Some of the natural features within these areas include "the northernmost stand of tree yuccas in the U.S., and a dinosaur quarry that has provided more than 20,000 fossil bones representing more than 60 individual animals from at least seven different genera of the Jurassic Period." (NPS, 2012b).

Figure 16.1.8-6: Little Rockies NNL

Source: (NPS, 2012c)

16.1.8.7. Additional Areas

National and State Scenic Byways

National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. The National Scenic Byways Program is managed by the U.S. Department of Transportation, Federal Highway Administration. Utah has eight designated National Scenic Byways (Figure 16.1.8-3):

- Dinosaur Diamond Prehistoric Highway (447 miles) (FHWA, 2015f),
- The Energy Loop: Huntington/Eccles Canyons Scenic Byway (85.9 miles) (FHWA, 2015g),
- Flaming Gorge-Uintas National Scenic Byway (82 miles) (FHWA, 2015h),
- Logan Canyon Scenic Byway (41 miles) (FHWA, 2015i),
- Nebo Loop Scenic Byway (37 miles) (FHWA, 2015d),
- Scenic Byway 12 (124 miles) (FHWA, 2015e),
- Scenic Byway 143 – Utah's Patchwork Parkway (51 miles) (FHWA, 2015k), and
- Trail of the Ancients (approximately 300 miles in Utah) (FHWA, 2015l). (FHWA, 2015e)

Similar to National Scenic Byways, Utah Scenic Byways are transportation corridors that are of particular statewide interest. There are 19 designated State Scenic Byways (Table 16.1.8-5).

Table 16.1.8-5: Utah Designated State Scenic Byways

Bear Lake-Laketown (10 miles)	Little Cottonwood Canyon (7 miles)
Beaver Canyon (24 miles)	Markagunt High Plateau (40 miles)
Big Cottonwood Canyon (15 miles)	Mirror Lake (56+ miles)
Capitol Reef (64 miles)	Mount Carmel (60 miles)
Cedar Breaks (6 miles)	Ogden River (34 miles)
Dead Horse Mesa (19 miles)	Potash-Lower Colorado River (34 miles)
Fish Lake (13 miles)	Provo Canyon (30 miles)
Great Salt Lake Legacy Parkway (14 miles)	Upper Colorado River (44 miles)
Kolob Fingers (5 miles)	Zion Park (54 miles)
Indian Creek (38 miles)	

Source: (Utah Office of Tourism, 2016f)

16.1.9. Socioeconomics

16.1.9.1. Definition of the Resource

NEPA requires consideration of socioeconomics; specifically, Section 102(A) of NEPA requires federal agencies to "insure the integrated use of the natural and social sciences…in planning and in decision making" (42 U.S.C. 4332(A)). Socioeconomics refers to a broad, social science-based approach to understanding a region's social and economic conditions. It typically includes population, demographic descriptors, economic activity indicators, housing characteristics, property values, and public revenues and expenditures (U.S. Bureau Land Management, 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 may have socioeconomic implications. Section 1.1 frames some of the public expenditure and public revenue considerations specific to FirstNet; however this is not intended to be either descriptive or prescriptive of FirstNet's financial model or anticipated total expenditures and revenues associated with the deployment of the Nationwide Public Safety Broadband Network (NPSBN). This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898. This PEIS addresses environmental justice in a separate section (Section 16.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: Land Use, Recreation, and Airspace (Section 16.1.7), Infrastructure (Section 16.1.1), and Visual Resources (Section 16.1.8).

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).[110]

[110] For U.S. Census Bureau sources, a URL (see references section) that begins with "http://factfinder.census.gov" indicates that the American FactFinder (AFF) interactive tool can be used to retrieve the original source data via the following procedure. If the reference's URL begins with "http://dataferrett.census.gov," significant socioeconomic expertise is required to navigate this interactive tool to the specific data. However, the data can usually be found using AFF. As of May 24, 2016, the AFF procedure is as follows: 1) Go to http://factfinder.census.gov. 2) Select "Advanced Search," then "Show Me All." 3) Select from "Topics" choices, select "Dataset," then select the dataset indicated in the reference; e.g. "American Community Survey, 2013 1-Year Estimates" or "2012 Census of Governments." Click "Close." Note: ACS is the abbreviation in the AFF for the American Community Survey. SF is the abbreviation used with the 2000 and 2010 "Summary Files." For references to the "2009-2013 5-Year Summary File," choose "2013 ACS 5-year estimates" in the AFF. 4) Click the "Geographies" box. Under "Select a geographic type," choose the appropriate type; e.g. "United States – 010" or "State – 040" or "..... County – 050" then select the desired area or areas of interest. Click "Add to Your Selections," then "Close." For

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.

16.1.9.2. 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.

16.1.9.3. Communities and Populations

This section discusses the population and major communities of Utah (UT) and includes the following topics:

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

Statewide Population and Population Growth

Table 16.1.9-1 presents the 2014 estimated population and population density of Utah in comparison to the Central region[111] and the nation. The estimated population of Utah in 2014 was 2,942,902. The population density was 36 persons per square mile (sq. mi.), which was lower than the population density of both the region (66 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Utah was the 33rd largest state by estimated population among the 50 states and the District of Columbia, 12th largest by land area, and had the 41st greatest population density (U.S. Census Bureau, 2015b; U.S. Census Bureau, 2015d).

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.

[111] The Central region is comprised of the states of Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Montana, 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 16.1.9-1: Land Area, Estimated Population, and Population Density of Utah

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Utah	82,170	2,942,902	36
Central Region	1,178,973	77,651,608	66
United States	3,531,905	318,857,056	90

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

Estimated population growth is an important subject for this PEIS, given FirstNet's mission. Table 16.1.9-2 presents the population growth trends of Utah from 2000 to 2014 in comparison to the Central region and the nation. The state's annual growth rate decreased in the 2010 to 2014 period compared to 2000 to 2010, from 2.16 percent to 1.58 percent. Although the rate decreased during this period, it was still considerably higher than the region. The growth rate of Utah in the latter period was also considerably higher than the growth rate of the region, at 0.45 percent, and the nation, at 0.81 percent.

Table 16.1.9-2: Recent Population Growth of Utah

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
Utah	2,233,169	2,763,885	2,942,902	530,716	179,017	2.16%	1.58%
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, 2015b)
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 16.1.9-3 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; UVA 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 Utah's estimated population will increase by 731,176 people, or 24.8 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 1.40 percent, which is somewhat lower than the historical growth rate from 2010 to 2014 of 1.58 percent. The projected growth rate of the state is higher than that of the region (0.60 percent) and the nation (0.80 percent).

Table 16.1.9-3: Projected Estimated Population Growth of Utah

Geography	Estimated Population 2014	Projected 2030 Estimated Population			Change Based on Average Projection		
		UVA Weldon Cooper Center Projection	Proximity One Projection	Average Projection	Numerical Change 2014 to 2030	Percent Change 2014 to 2030	Rate of Change (AARC) 2014 to 2030
Utah	2,942,902	3,606,802	3,741,353	3,674,078	731,176	24.8%	1.40%
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, 2015b; ProximityOne, 2015; UVA Weldon Cooper Center, 2015)
AARC = Average Annual Rate of Change (compound growth rate)

Population Distribution and Communities

Figure 16.1.9-1 presents the distribution and relative density of the estimated population of Utah. 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, 2015u).

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, 2015e). 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. Outside of the population concentrations, much of the state is very sparsely populated.

Table 16.1.9-4 provides the populations of the 10 largest population concentrations in Utah, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[112] In 2010, the largest population concentration was the Salt Lake City/West Valley City area, which had over one million people. The state had no other population concentrations over one million, and it had two areas with populations of approximately 500,000. The other seven areas had populations under 100,000. The smallest of these 10 population concentrations was the Hurricane area, with a 2010 population of 16,336. The fastest growing area, by average annual rate of change from 2000 to 2010, was also the

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

Hurricane area, with an annual growth rate of 7.08 percent. All 10 areas had growth rates over 1.00 percent, and seven of the 10 areas had growth rates over 3.00 percent. However, these high growth rates reflect large increases in the area definitions for these areas. These area expansions may have taken in some existing populations; thus, the growth rates of these areas may reflect this factor as well as organic growth (net in-migration and/or births exceeding deaths).

Table 16.1.9-4 also shows that the top 10 population concentrations in Utah accounted for over 85 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 101.2 percent of the entire state's growth. This figure of over 100 percent indicates that the population of the remainder of the state, as a whole, declined from 2000 to 2010.

Table 16.1.9-4: Population of the 10 Largest Population Concentrations in Utah

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Cedar City*	21,978	33,200	33,537	6	11,222	4.21%
Heber*	9,792	17,212	18,045	9	7,420	5.80%
Hurricane*	8,246	16,336	16,355	10	8,090	7.08%
Logan	76,187	94,983	96,468	5	18,796	2.23%
Ogden/Layton	417,933	546,026	554,261	2	128,093	2.71%
Provo/Orem*	303,680	482,819	493,767	3	179,139	4.75%
Salt Lake City/West Valley City	887,650	1,021,243	1,038,514	1	133,593	1.41%
St. George	62,630	98,370	101,583	4	35,740	4.62%
Tooele	21,834	31,058	31,493	7	9,224	3.59%
Vernal*	11,569	17,321	19,094	8	5,752	4.12%
Total for Top 10 Population Concentrations	**1,821,499**	**2,358,568**	**2,403,117**	**NA**	**537,069**	**2.62%**
Utah (statewide)	**2,233,169**	**2,763,885**	**2,813,673**	**NA**	**530,716**	**2.16%**
Top 10 Total as Percentage of State	**81.6%**	**85.3%**	**85.4%**	**NA**	**101.2%**	**NA**

Sources: (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015f; U.S. Census Bureau, 2015g)
AARC = Average Annual Rate of Change
*The large population increases from 2000 to 2010 for these areas reflect large increases in the area definition for each of these areas. For example, the Provo/Orem urbanized area increased from 85 sq. mi. in 2000 to 169 sq. mi. in 2010.

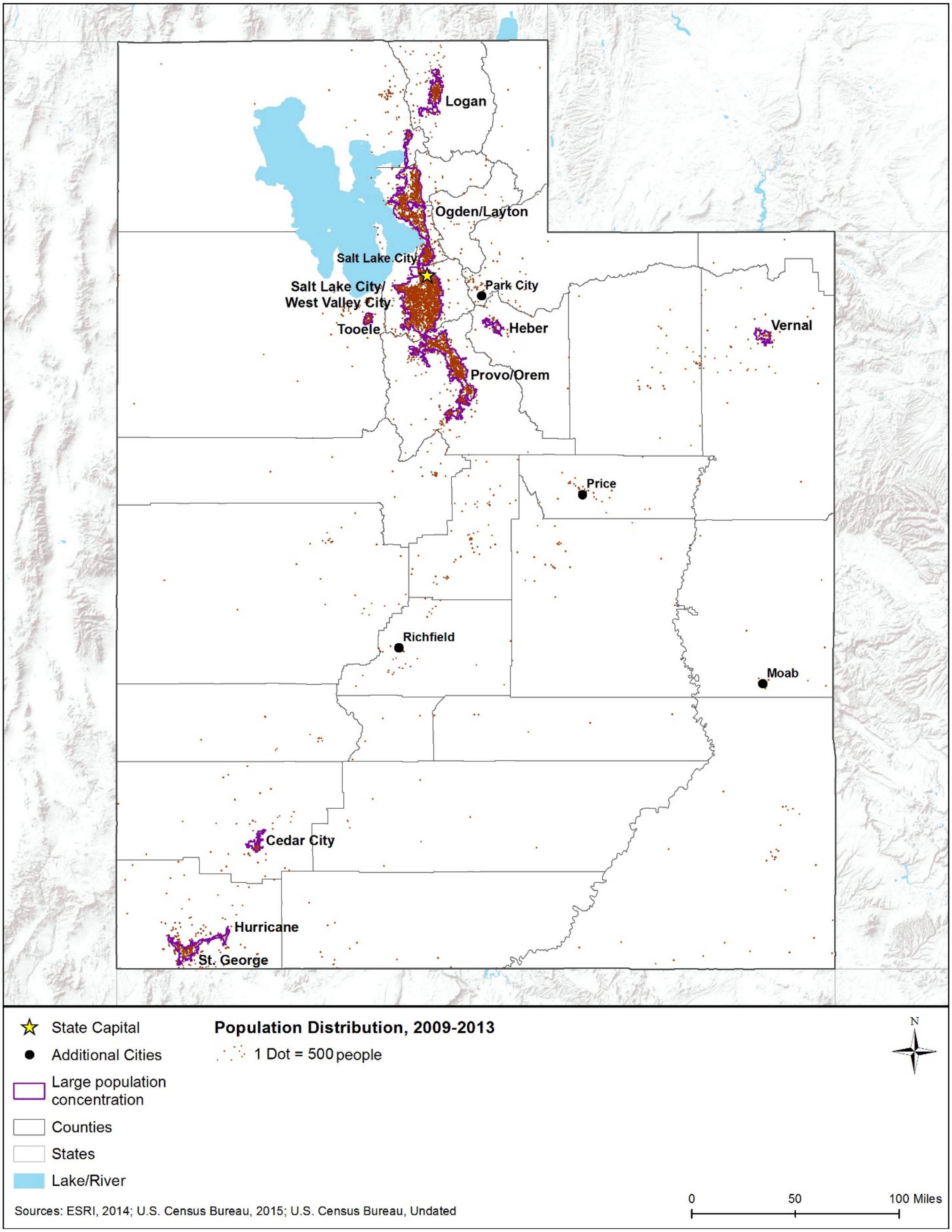

Figure 16.1.9-1: Estimated Population Distribution in Utah, 2009–2013

16.1.9.4. 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 16.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 16.1.9-5 compares several economic indicators for Utah to the Central region and the nation. The table presents two indicators of income[113] – 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 16.1.9-5, the per capita income in Utah in 2013 ($24,250) was $3,278 lower than that of the region ($27,528), and $3,934 lower than that of the nation ($28,184) (Bureau of Labor Statistics, 2015g; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k)

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 16.1.9-5 shows that in 2013, the MHI in Utah ($59,715) was $7,670 higher than that of the region ($52,045), and $7,465 higher than that of the nation ($52,250) (Bureau of Labor Statistics, 2015g; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k).

[113] 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, 2015h).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the unemployment rate as the number of unemployed individuals who are looking for work divided by the total number of individuals in the labor force. Table 16.1.9-5 compares the unemployment rate in Utah to the Central region and the nation. In 2014, Utah's statewide unemployment rate of 3.8 percent was considerably lower than the rates for the region (5.7 percent) and the nation (6.2 percent)[114] (Bureau of Labor Statistics, 2015g; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k).

Table 16.1.9-5: Selected Economic Indicators for Utah

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Utah	$24,250	$59,715	3.8%
Central Region	$27,528	$52,045	5.7%
United States	$28,184	$52,250	6.2%

Sources: (Bureau of Labor Statistics, 2015g; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k)

Figure 16.1.9-2 and Figure 16.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015i) and unemployment in 2014 (Bureau of Labor Statistics, 2015g) varied by county across the state. These maps also incorporate the same population concentration data as Figure 16.1.9-1 (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015e). Following these two maps, Table 16.1.9-6 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 Utah.

Figure 16.1.9-2 shows that counties with a MHI above the national median were all in the northern portion of the state. The remainder of the state had MHI levels below the national average. Cache County (which includes the city of Logan) in the northern part of the state also had a MHI level below the national average. Table 16.1.9-6 shows that MHI levels in the Heber, Ogden/Layton, Provo/Orem, Salt Lake City/West Valley City, and Vernal areas were above the state average. MHI in all other population concentrations was below the state average. MHI was lowest in the Cedar City and Hurricane areas. These are two of the five smallest areas shown in the table, both with populations under 40,000.

Figure 16.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that counties with unemployment rates below the national average (that is, better employment performance) were distributed throughout most of the state. However, four counties in the sparsely populated, southeastern part of the state had unemployment rates above the national average. When comparing unemployment in the population concentrations to the state average (Table 16.1.9-6), five of the areas had 2009–2013 unemployment rates that were higher

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

than the state average. The highest unemployment rates were in the Cedar City and St. George areas.

Detailed employment data provides useful insights into the nature of a local, state, or national economy. Table 16.1.9-7 provides figures on employment percentages by type of worker and by industry based on surveys conducted in 2013 by the Census Bureau. By class of worker (type of worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers in Utah was somewhat lower than in the Central region and very similar to the nation. The percentage of government workers was higher in the state than in the region and nation. Self-employed workers were a lower percentage in the state than in the region and nation.

By industry, Utah has a mixed economic base. Utah in 2013 had a similar percentage (within two percentage points) of workers in most industries compared to the region and nation. In comparison to the region, Utah had a notably lower percentage of persons working in the "manufacturing" industry, and a notably higher percentage working in the "professional, scientific, management, administrative, and waste management services" industry.

Table 16.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in Utah, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Cedar City	$41,523	14.7%
Heber	$65,546	6.2%
Hurricane	$45,489	6.6%
Logan	$48,082	7.4%
Ogden/Layton	$62,039	6.4%
Provo/Orem	$59,189	7.3%
Salt Lake City/West Valley City	$60,350	7.6%
St. George	$48,863	10.4%
Tooele	$57,645	8.2%
Vernal	$62,227	8.1%
Utah (statewide)	$58,821	7.4%

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

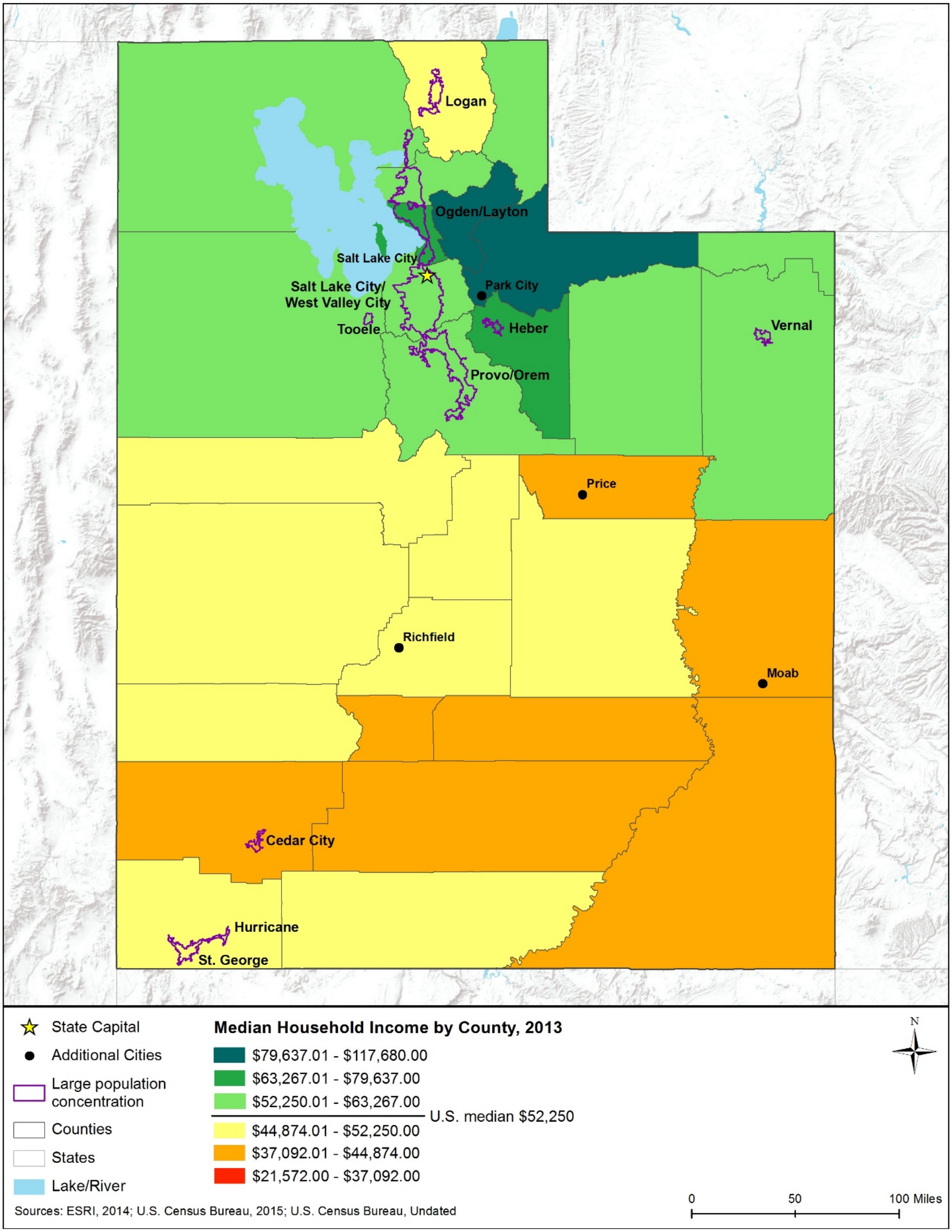

Figure 16.1.9-2: Median Household Income in Utah, by County, 2013

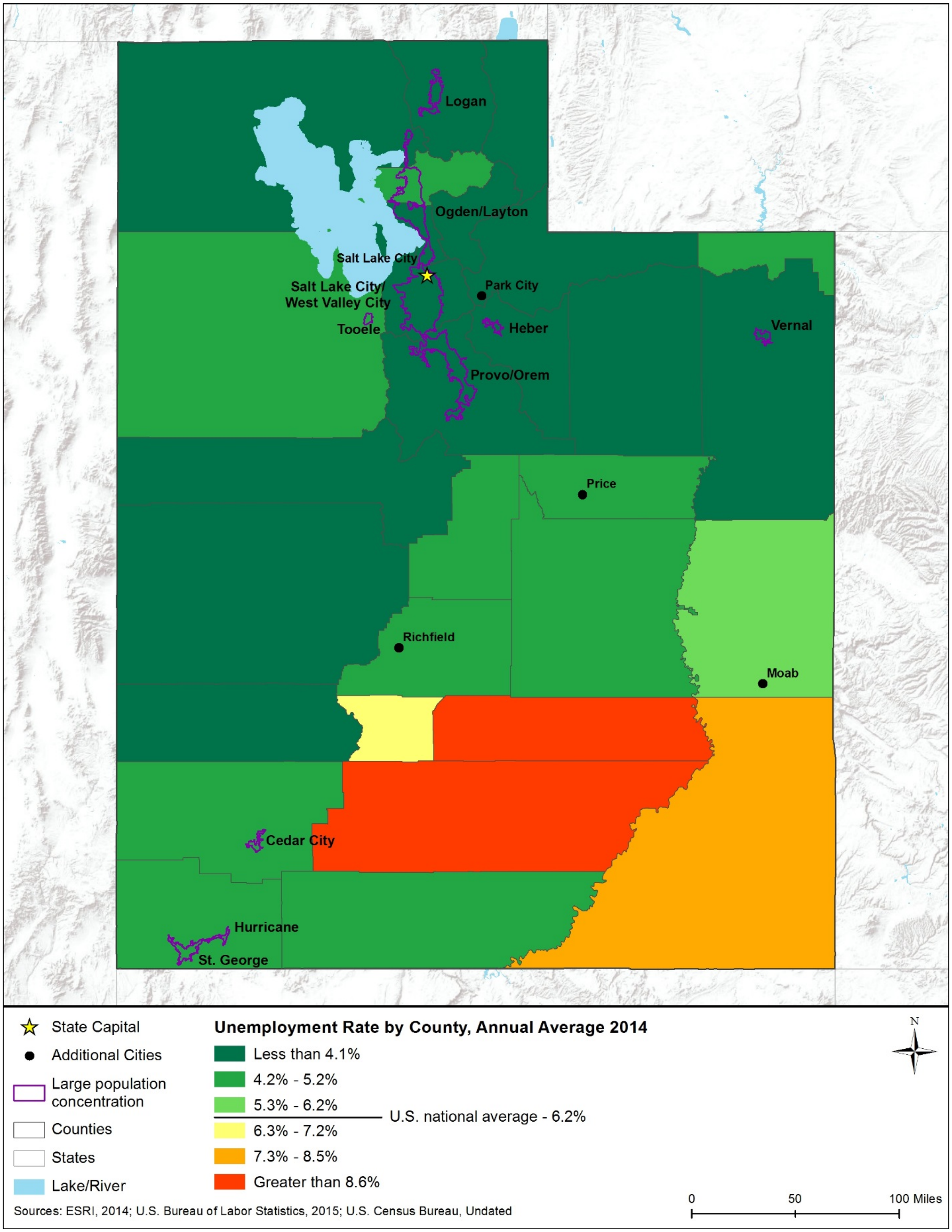

Figure 16.1.9-3: Unemployment Rates in Utah, by County, 2014

Table 16.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	Utah	Central Region	United States
Civilian Employed Population 16 Years and Over	1,327,452	36,789,905	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	79.9%	81.7%	79.7%
Government workers	15.2%	12.8%	14.1%
Self-employed in own not incorporated business workers	4.7%	5.3%	6.0%
Unpaid family workers	0.2%	0.2%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	2.1%	2.2%	2.0%
Construction	6.4%	5.6%	6.2%
Manufacturing	11.0%	14.0%	10.5%
Wholesale trade	2.5%	2.7%	2.7%
Retail trade	12.6%	11.5%	11.6%
Transportation and warehousing, and utilities	4.6%	4.9%	4.9%
Information	2.2%	1.9%	2.1%
Finance and insurance, and real estate and rental and leasing	6.5%	6.5%	6.6%
Professional, scientific, management, administrative, and waste management services	11.7%	9.7%	11.1%
Educational services, and health care and social assistance	22.0%	23.4%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	8.9%	9.1%	9.7%
Other services, except public administration	4.6%	4.6%	5.0%
Public administration	4.9%	3.9%	4.7%

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

Table 16.1.9-8 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 16.1.9-7 for 2013.

Table 16.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in Utah, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Cedar City	4.8%	1.7%	1.2%	7.6%
Heber	10.2%	6.2%	0.6%	11.1%
Hurricane	8.2%	3.8%	0.8%	7.1%
Logan	4.4%	2.3%	2.3%	10.1%
Ogden/Layton	6.0%	4.3%	1.7%	10.5%
Provo/Orem	6.0%	2.5%	2.5%	14.0%
Salt Lake City/West Valley City	6.5%	5.4%	2.5%	12.5%
St. George	7.8%	5.2%	1.6%	9.3%
Tooele	6.4%	7.1%	1.9%	12.3%
Vernal	5.6%	6.1%	0.7%	7.9%
Utah (statewide)	6.5%	4.7%	2.1%	11.4%

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

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 16.1.9-9 compares Utah to the Central region and nation on several common housing indicators.

As shown in Table 16.1.9-9, in 2013, Utah had a higher percentage of housing units that were occupied (89.4 percent) than the region (88.4 percent) or nation (87.6 percent). Of the occupied units, Utah had a higher percentage of owner-occupied units (69.2 percent) than the region (67.6 percent) or nation (63.5 percent). Likewise, Utah in 2013 had a higher percentage of detached single-unit housing (also known as single-family homes) (69.3 percent) compared to the region (67.7 percent) and nation (61.5 percent). The homeowner vacancy rate in Utah (1.6 percent) was slightly lower than the rates for the region (1.8 percent) and nation (1.9 percent). This rate reflects “vacant units that are ‘for sale only’” (U.S. Census Bureau, 2015h). The vacancy rate among rental units in Utah (6.0 percent) matched the rate for the region and was lower than the rate for the nation (6.5 percent).

Table 16.1.9-9: Selected Housing Indicators for Utah, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Utah	1,006,164	89.4%	69.2%	1.6%	6.0%	69.3%
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, 2015n)

Table 16.1.9-10 provides housing indicators for the largest population concentrations in the state by survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does present variation in these indicators for population concentrations across the state and compared to the state average for the 2009 to 2013 period. Table 16.1.9-10 shows that during this period the percentage of occupied housing units ranged from 83.0 to 95.4 percent across these population concentrations, compared to the state average (89.7 percent).

Table 16.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Utah, 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
Cedar City	12,207	90.0%	57.0%	4.2%	11.7%	55.3%
Heber	5,903	88.3%	74.2%	0.6%	3.0%	78.3%
Hurricane	5,939	85.4%	72.8%	1.4%	8.0%	75.1%
Logan	31,561	94.9%	61.0%	1.3%	2.4%	64.4%
Ogden/Layton	186,510	95.2%	74.7%	1.2%	5.5%	72.9%
Provo/Orem	140,086	95.4%	66.5%	1.7%	2.9%	64.6%
Salt Lake City/West Valley City	362,273	94.2%	67.2%	1.8%	5.9%	64.0%
St. George	41,178	83.0%	67.0%	3.2%	5.0%	70.8%
Tooele	10,675	94.3%	72.5%	2.4%	6.4%	77.5%
Vernal	6,837	91.4%	69.5%	3.0%	6.0%	68.4%
Utah (statewide)	988,571	89.7%	70.1%	1.8%	5.9%	68.8%

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

Property Values

Property values have important relationships to both the wealth and affordability of communities. Table 16.1.9-11 provides indicators of residential property values for Utah 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, 2015h).

The table shows that the median value of owner-occupied units in Utah in 2013 ($211,400) was considerably higher than the corresponding values for the Central region ($151,200) and the nation ($173,900).

Table 16.1.9-11: Residential Property Values in Utah, 2013

Geography	Median Value of Owner-Occupied Units
Utah	$211,400
Central Region	$151,200
United States	$173,900

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

Table 16.1.9-12 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 values for the Heber ($287,900), Provo/Orem ($221,800), and Salt Lake City/West Valley City ($231,100) areas were higher than the state median value ($212,800). All other population concentrations had property values below the state value. The lowest values were in the Cedar City, Hurricane, and Tooele areas. The Cedar City and Hurricane areas also had the lowest median household incomes (Table 16.1.9-6).

Table 16.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in Utah, 2009–2013

Area	Median Value of Owner-Occupied Units
Cedar City	$166,200
Heber	$287,900
Hurricane	$167,300
Logan	$186,800
Ogden/Layton	$196,100
Provo/Orem	$221,800
Salt Lake City/West Valley City	$231,100
St. George	$210,300
Tooele	$162,500
Vernal	$196,900
Utah (statewide)	$212,800

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

Government Revenues

State and local governments obtain revenues from many sources. FirstNet projects may affect flows of revenue sources between different levels of government due to program financing and intergovernmental agreements for system development and operation. Public utility taxes[115] 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, 2006a). 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 16.1.9-13 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 16.1.9-13 shows that the Utah state government received less revenue in 2012 on a per capita basis than its counterpart governments in the region and nation. Local governments in Utah received more total revenue per capita than counterparts in the region, but less than their counterparts in the nation. Additionally, the Utah state government

[115] 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, 2006b).

had lower levels of intergovernmental revenues[116] from the federal government, while Utah local governments had higher levels of these revenues. For every type of tax revenue presented in the table, the Utah state government obtained lower per capita revenue than counterparts in both the region and nation. The Utah state government obtained no revenue from property taxes. Local governments in Utah obtained levels of property taxes per capita that were higher than local governments in the region, but lower than local governments in the nation. For both general and selective sales taxes, Utah local governments received higher per capita revenues than counterparts in both the region and nation. Utah local governments received no revenues from individual and corporate income taxes.

Table 16.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue	Utah		Region		United States	
	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue($M)	$15,601	$11,364	$463,192	$231,980	$1,907,027	$1,615,194
Per capita	$5,464	$3,980	$6,020	$3,015	$6,075	$5,145
Intergovernmental from Federal ($M)	$4,481	$673	$125,394	$9,383	$514,139	$70,360
Per capita	$1,570	$236	$1,630	$122	$1,638	$224
Intergovernmental from State ($M)	$0	$2,905	$0	$76,288	$0	$469,147
Per capita	$0	$1,017	$0	$992	$0	$1,495
Intergovernmental from Local ($M)	$6	$0	$2,721	$0	$19,518	$0
Per capita	$2	$0	$35	$0	$62	$0
Property Taxes($M)	$0	$2,679	$3,626	$61,015	$13,111	$432,989
Per capita	$0	$938	$47	$793	$42	$1,379
General Sales Taxes($M)	$1,857	$642	$58,236	$6,920	$245,446	$69,350
Per capita	$650	$225	$757	$90	$782	$221
Selective Sales Taxes($M)	$865	$297	$33,313	$2,191	$133,098	$28,553
Per capita	$303	$104	$433	$28	$424	$91
Public Utilities Taxes($M)	$26	$122	$3,627	$1,153	$14,564	$14,105
Per capita	$9	$43	$47	$15	$46	$45
Individual Income Taxes($M)	$2,466	$0	$72,545	$5,148	$280,693	$26,642
Per capita	$864	$0	$943	$67	$894	$85
Corporate Income Taxes($M)	$259	$0	$9,649	$310	$41,821	$7,210
Per capita	$91	$0	$125	$4	$133	$23

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

[116] 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, 2006b).

16.1.10.Environmental Justice

16.1.10.1. Definition of the Resource

EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO (see Section 16.1.11). 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, 2016b). Under the EO, each federal agency must "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Office of the President, 1994). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (U.S. Department of Commerce, 2013).

In 1997, the Council on Environmental Quality (CEQ) issued Environmental Justice: Guidance under the National Environmental Policy Act (NEPA) to assist federal agencies in meeting the requirements of the EO (CEQ, 1997). Additionally, the USEPA's Office of Environmental Justice (USEPA, 2015a) 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).

16.1.10.2. Specific Regulatory Considerations

Research for this section did not identify any specific state regulations or policies that are directly relevant to environmental justice for this PEIS. However, the mission of the Office of Planning and Public Affairs at the UDEQ includes improving the effectiveness of the Department by partnering in areas such as stakeholder involvement and environmental justice (UDEQ, 2015l).

16.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 16.1.10-1 presents 2013 data on the composition of Utah's estimated population by race and by Hispanic origin. The state's estimated population has substantially lower percentages of individuals who identify as Black/African American (1.1 percent), in comparison to the Central region (9.3 percent) and the nation (12.6 percent). Utah has somewhat higher percentages of individuals identifying as American Indian/Alaska Native (1.1 percent), Native Hawaiian/Pacific Islander (0.9 percent), and Some Other Race (4.8 percent) than the estimated populations of the Central region and the nation. (Those percentages are, for American Indian/Alaska Native, 0.7 percent for the Central region and 0.8 percent for the nation; for Native Hawaiian/Pacific Islander, 0.1 percent and 0.2 percent respectively; and for Some Other Race, 2.4 percent and 4.7 percent respectively.) The population of individuals identifying as Asian is somewhat lower in Utah (2.2 percent) than in the Central region (2.8 percent) and considerably lower than that of the nation (5.1 percent). The state's estimated population of persons identifying as White (87.4 percent) is considerably larger than that of the Central region (82.2 percent) and the nation (73.7 percent).

The percentage of the estimated population in Utah that identifies as Hispanic (13.4 percent) is considerably larger than in the Central region (8.5 percent), and somewhat lower 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. Utah's All Minorities estimated population percentage (20.5 percent) is somewhat lower than that of the Central region (23.3 percent) and substantially lower than that of the nation (37.6 percent).

"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 16.1.10-2 presents the percentage of the estimated population living in poverty in 2013, for the state, region, and nation. The figure for Utah (12.7 percent) is lower than that for the Central region (14.7 percent) and the nation (15.8 percent).

Table 16.1.10-1: 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		
Utah	2,900,872	87.4%	1.1%	1.1%	2.2%	0.9%	4.8%	2.4%	13.4%	20.5%
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, 2015r)
“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 16.1.10-2: Percentage of Estimated Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Utah	12.7%
Central Region	14.7%
United States	15.8%

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

16.1.10.4. 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 16.1.10-1 visually portrays the results of the environmental justice population screening analysis for Utah. The analysis used block group data from the Census Bureau’s American Community Survey 2009-2013 5-Year Estimates and Census Bureau urban classification data (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015e).

Figure 16.1.10-1 shows that Utah has many areas with High Potential for environmental justice populations. The distribution of these High Potential areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations, including some of the state’s most sparsely populated areas. The distribution of areas with Moderate Potential for environmental justice populations is also fairly even across the state.

It is important to understand how the data behind Figure 16.1.10-1 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 16.1.10-1 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 16.2) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

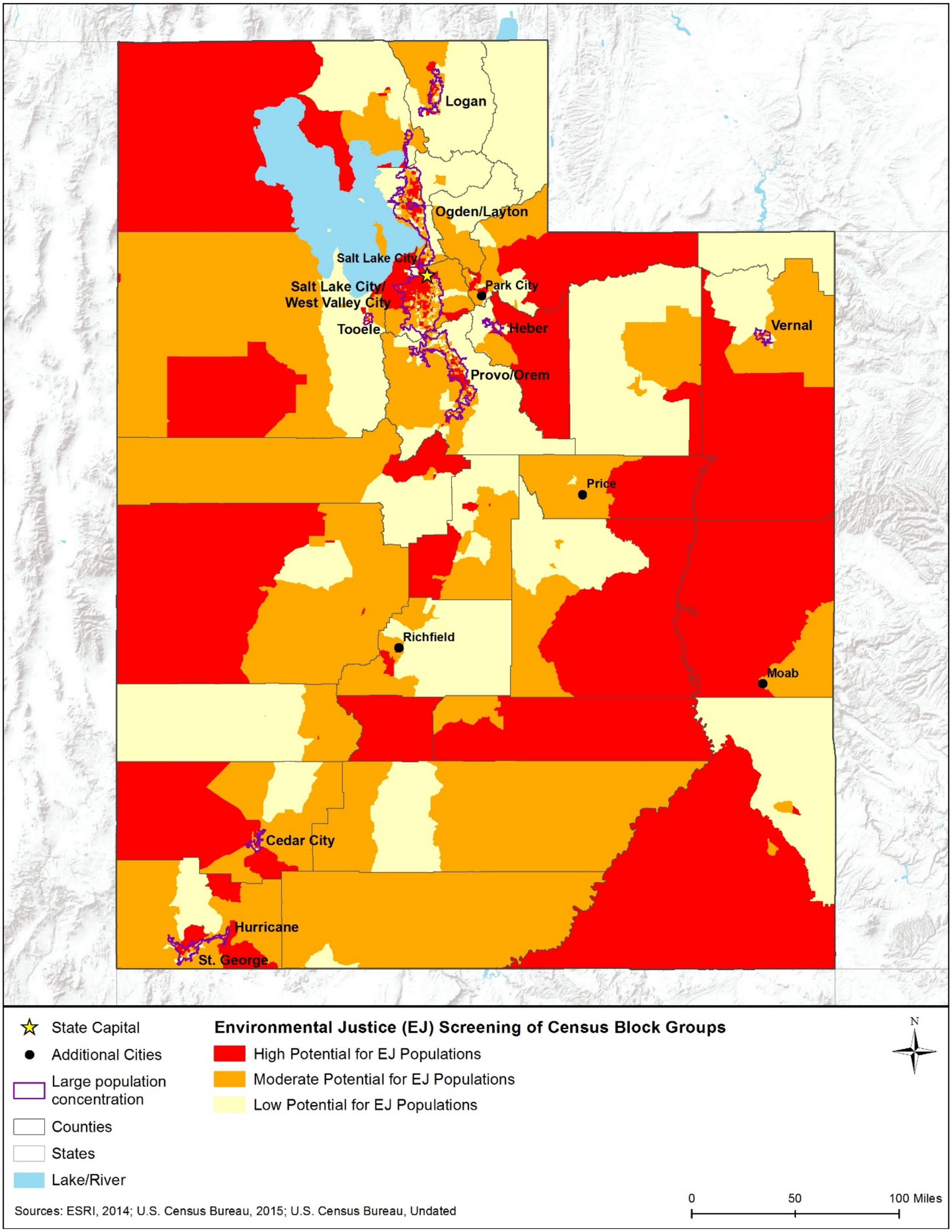

Figure 16.1.10-1: Potential for Environmental Justice Populations in Utah, 2009–2013

16.1.11.Cultural Resources

16.1.11.1. Definition of Resource

For the purposes of this Programmatic Environmental Impact Statement (PEIS), Cultural Resources are defined as:

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

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

- The statutory language and implementing regulations for Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- The 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);
- The 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);
- The National Park Service's (NPS) program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources (NPS, 2015h); and
- The 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).

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

Utah has state regulations that are similar to the NHPA (refer to Table 16.1.11-1). However, federal regulations supersede these 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 16.1.11-1: Relevant Utah Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Section 404 Review (Utah Code Annotated 9-8-404)	Utah State Historic Preservation Office (SHPO)	This Regulation mirrors the NHPA for actions using state funding, requiring agencies to consult with SHPO regarding potential impacts to historic properties.

16.1.11.3. Cultural Setting

Human beings have inhabited Utah region for at least 11,000 years (Utah State Historical Society, 2015; Utah Statewide Archaeological Society, 2002). The majority of Utah'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 290 archaeological sites in the state listed on the NRHP: 8 historic; 276 prehistoric; and 6 sites that have both historical and prehistoric provenance (National Park Service, 2014).

Archaeologists typically divide large study areas into regions. As shown in Figure 16.1.3-1, Utah occupies two physiographic regions: Interior Plains and Rocky Mountain System. The Rocky Mountain region is further divided into two provinces. The Middle Rocky Mountains province is in the south central part of the state. The Central Rocky Mountains province spans the full length of the western part of the state between the Canada to the north, Idaho to the west and southwest, and to the northwest corner of Wyoming. The Great Plains is the largest physiographic province of Utah covering the entire boundary of the Interior Plains region.

Evidence at most archeological sites in Utah are in relatively shallow deposits, on the surface or within one to two feet of the surface. 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). Archaeological sites in Utah are present in the desert, high mountains, badlands, and marshes (Utah State Historical Society, 2015).

The following sections provide additional detail about Utah's prehistoric periods (approximately 9000 B.C. – A.D. 1600) and the historic period since European contact in the 1500s. Section 16.1.11.4 presents an overview of the initial human habitation in Utah and the cultural development that occurred before European contact. Section 16.1.11.5 discusses the federally recognized American Indian Tribes with a cultural affiliation to the state. Section 16.1.11.6 provides a current list of significant archaeological sites in Utah and tools that the state has developed to ensure their preservation. Section 16.1.11.7 document the historic context of the state since European contact, and Section 16.1.11.8 summarizes the architectural context of the state during the historic period.

16.1.11.4. Prehistoric Setting

Archaeologists divide Utah's prehistoric past into three periods: Paleoindian Period (9000 – 6000 B.C.), Archaic Period (6000 - 500 B.C.), and Fremont Period (500 B.C. – A.D. 1600) (Utah State Historical Society, 2015). Figure 16.1.11-1 shows a timeline representing these periods of early human habitation of present day Utah. 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 Utah's 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).

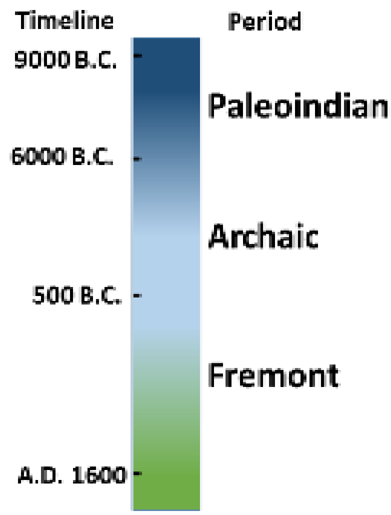

Figure 16.1.11-1: Timeline of Prehistoric Human Occupation

Sources: (Institute of Maritime History, 2015; Utah State Historical Society, 2015)

Paleoindian (9000 - 6000 B.C.)

The Paleoindian Period represents the earliest human habitation Utah. The earliest people to occupy the state ("Clovis" people) 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 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 Utah can be attributed to the discovery of fluted points found in surface and shallow deposits throughout the state. Paleoindian sites in Utah are rare, due to their age. A Paleoindian campsite found along the shoreline of Lake Gilbert, Utah, provides evidence that these early people survived in areas such as marshes (Utah State Historical Society, 2015). The people of this period ranged across the state in small bands, following migratory game, such as giant bison, mammoth, and other large mammals (Bamforth, 2011). Early Paleoindian settlers in Utah developed communal hunting practices, whereby large groups of people worked together to run herds of bison over a cliff to kill them. These hunting groups established seasonal camps, some of which likely became permanent settlements.

Ancestors of Utah's Paleoindians are believed to have migrated to North America via the Bering Land Bridge during the latter part of the last ice age (Late Pleistocene epoch) (Bamforth, 2011; Frison, 1990; Frison, 1998). Around ten to seven thousand years ago, there was a gradual warming trend in this region, and the Folsom culture replaced the Clovis culture of the Utah region. The Folsom culture had more advanced methods for hunting bison, which is believed to have led to overhunting in the region (Bamforth, 2011; Frison, 1998).

Archaic Period (6000 - 500 B.C.)

During the Archaic Period, the climate of the Utah region was warming and becoming drier. The changing environment forced the Archaic Period people to diversify their diet away from big game to plants and smaller game. The hunting implements of this period were initially more crudely manufactured than those of the Clovis and Folsom people. Archaic Period people in the Utah region had semi-permanent villages, and used caves and rock shelters for protection from the elements. (Utah State Historical Society, 2015).

Evidence of the manufacturing of baskets and unfired pottery indicates that American Indian technology became increasingly sophisticated as the Archaic Period progressed. The baskets would have been used to collect and store wild edible plants and other items. Early and Middle Archaic Period hunting artifacts include stone-tipped spears to hunt small game, as well as the atlatl (spear thrower) for larger game. The Danger and Jukebox caves, near Wendover, UT, are well-documented Archaic Period sites which yielded seeds, animal hair, evidence of cooking hearths, shaped wood, and basketry remnants (Utah State Historical Society, 2015).

Figurines discovered at Cowboy and Walters caves in southeastern Utah are presumed to be the earliest known artifacts of their kind and date to about 5,600-5,000 B.C. These unfired artifacts are rare in comparison to other Archaic Period artifacts. More recent and more common, so-called Horseshoe Shouldered figurines are anthropomorphic in style, meaning they are shaped like humans (Coulam & Schroedl, Early Archaic Clay Figurines from Cowboy and Walters Caves in Southeastern Utah, 1996). Other figurines from the Late Archaic Period have been found throughout the North American southwest. It is hypothesized that the figurines were used as totems (Coulam & Schroedl, 2004).

Across the region, hunting and gathering was the predominant way of life much longer than other parts of North America, likely because maize agriculture was not introduced into the area until 1800 B.C. (Jelks, 1992). Toward the end of the Archaic Period, the bow and arrow was invented, which enabled more efficient hunting of small and medium sized game, such as deer, rabbits, and antelope.

Fremont Period (500 B.C. – A.D. 1600)

The Fremont Period in the Utah region is characterized by development of early agriculture, which supplemented the diet of the inhabitants, who were continuing a predominately hunter-gatherer lifestyle (Utah State Historical Society, 2015; Sharp, 1990). The Anasazi people of the Fremont Period introduced corn, beans, and squash, which they brought northward into Utah from the Four Corners Region.[117] They also domesticated turkeys, which they used for food and to make various musical instruments (from turkey bones). The Anasazi are also well known for their multi-storied homes built in and around cliff faces and deep canyons. For reasons likely

[117] Four Corners Region is the area of the Southwestern United States where the states of Arizona, Colorado, New Mexico, and Utah meet.

relating to drought, failed crops, and conflict with other tribes in the region, the Anasazi people of the Fremont Period abandoned their homes around A.D. 1300 and returned to a life of hunting and gathering as a means for subsistence (Utah State Historical Society, 2015; Kloor, 2007).

16.1.11.5. Federally Recognized Tribes of Utah

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are eight federally recognized Tribes in Utah (National Conference of State Legislators, 2015):

- Confederated Tribes of the Goshute Reservation,
- Navajo Nation,
- Northwestern Band of Shoshone Nation of Utah,
- Paiute Indian Tribe of Utah,
- Skull Valley Band of Goshute Indians of Utah,
- Ute Indian Tribe of the Uintah and Ouray Reservation, and
- Ute Mountain Ute Tribe.

The location of federally recognized tribes are shown in in Figure 16.1.11-2. The other tribes depicted on the figure are general locations of tribes that were known to exist in this region of the United States, but are not officially federally recognized.

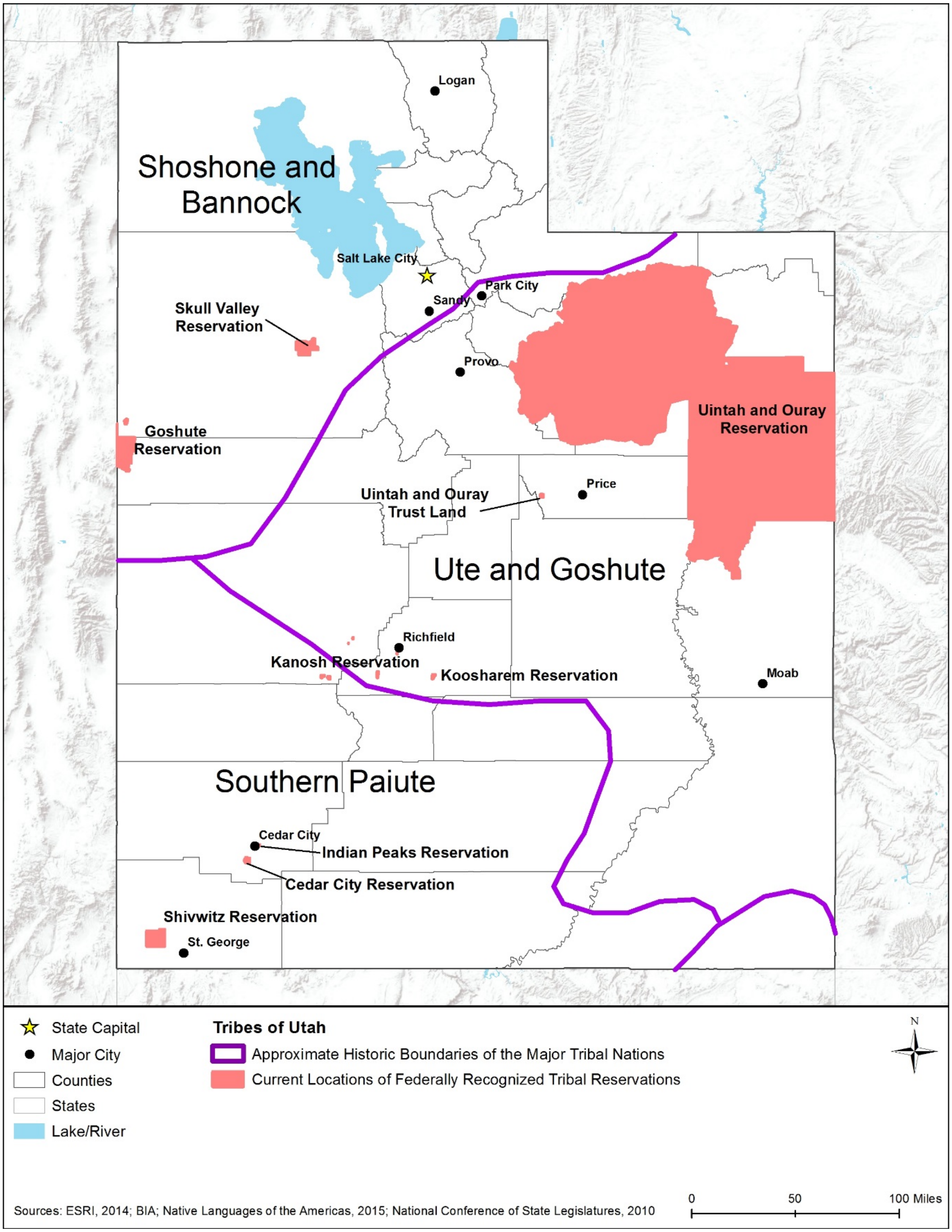

Figure 16.1.11-2: Federally Recognized Tribes in Utah

16.1.11.6. Significant Archaeological Sites of Utah

As previously mentioned in Section 16.1.11.3 there are 290 archaeological sites in Utah listed on the NRHP. Table 16.1.11-2 lists the names of the sites, the city they are closest to, and type of site. The list includes both prehistoric and historic archaeological sites. The number of archaeological sites may increase with the discovery of new sites. A current list of NRHP sites are listed on the NPS NRHP website at http://www.nps.gov/nr/ (NPS, 2014e).

Utah State Cultural Resources Database and Tools

Utah State Historic Preservation Office (SHPO)

The Utah State Historic Preservation Office provides information on regional history. The SHPO website (https://heritage.utah.gov/history/what-we-do) contains several resources including preservation news, publications, library information, and access to various digital collections. Users may interact with historical artifacts using the website's 360-degree gallery titled "The Power of Objects" (Utah Division of State History, 2016).

Utah History to Go

"Utah History to Go," found at http://www.historytogo.utah.gov/, is a free online course for those interested in learning about Utah history and prehistory. The course has eight chapters designed to provide a broad overview of subjects necessary to understand the historical context of the region. The website also provides fact sheets, timelines, and information pages on historically prominent Utah people and places (State of Utah, 2015c).

Utah Statewide Archaeological Society (USAS)

The Utah Statewide Archaeological Society is an organization open to the public for those interested in archaeology and prehistoric cultures. There are eight chapters of the USAS, whose goals are to promote and preserve regional archaeology through volunteer work and public outreach. The USAS website (http://utaharchaeology.org/) provides users with preservation news, volunteer opportunities, and access to its chapter newsletters. Information on society membership, which includes a subscription to the annual publication *Utah Archaeology*, is also available (Utah Statewide Archaeological Society, 2002).

Table 16.1.11-2: Archaeological Sites on the National Register of Historic Places in Utah

Closest City	Site Name	Type of Site
Aneth	Aneth Terrace Archeological District	Historic - Aboriginal, Prehistoric
Beaver	Ryan Ranch (42BE618)	Prehistoric
Blanding	Big Westwater Ruin	Prehistoric
Blanding	Butler Wash Archeological District	Prehistoric
Blanding	Defiance House	Prehistoric
Blanding	Grand Gulch Archeological District	Prehistoric
Blanding	Natural Bridges Archeological District	Prehistoric
Blanding	Patterson, Nancy, Site	Prehistoric

Closest City	Site Name	Type of Site
Blanding	Westwater Canyon Archeological District	Prehistoric
Bluff	Sand Island Petroglyph Site	Prehistoric
Brigham City	Lower Bear River Archeological Discontiguous District	Prehistoric
Callao	Fish Springs Caves Archeological District	Prehistoric
Castle Dale	Buckhorn Wash Rock Art Sites	Prehistoric
Deseret	Deseret (42MD55)	Prehistoric
Echo	Echo Canyon Breastworks	Military
Emery	Rochester-Muddy Creek Petroglyph Site	Prehistoric
Escalante	Friendship Cove Pictograph	Prehistoric
Ferron	Ferron Box Pictographs and Petroglyphs	Prehistoric
Fillmore	Site 42MD284	Prehistoric
Garrison	Mud Spring	Prehistoric
Glen Canyon	Davis Gulch Pictograph Panel	Prehistoric
Goshen	Old Goshen Site	Historic
Green River	Black Dragon Canyon Pictographs	Prehistoric
Green River	Cowboy Caves	Prehistoric
Green River	Harvest Scene Pictograph	Prehistoric
Green River	Horseshoe (Barrier) Canyon Pictograph Panels	Prehistoric
Hanksville	Temple Mountain Wash Pictographs	Prehistoric
Hanksville	Bull Creek Archeological District	Prehistoric
Jensen	Cockleburr Wash Petroglyphs	Historic – Aboriginal
Kanab	Cottonwood Canyon Cliff Dwelling	Prehistoric
Manila	Manila Petroglyphs	Prehistoric
Mexican Hat	Poncho House	Prehistoric
Milford	Wildhorse Canyon Obsidian Quarry	Prehistoric
Milford	Cottonwood Wash (42MD183)	Prehistoric
Milford	Mountain Home Wash	Prehistoric
Millard	Archeological Site No. 42Md300	Prehistoric
Monticello	Alkali Ridge	Prehistoric
Monticello	Salt Creek Archeological District	Prehistoric
Nephi	Nephi Mounds	Prehistoric
Panguitch	Pole Hollow Archeological Site	Prehistoric
Park Valley	Hogup Cave (42BO36)	Prehistoric
Parowan	Long Flat Site	Historic - Aboriginal, Prehistoric
Parowan	Parowan Gap Petroglyphs	Prehistoric
Porterville	Mormon Flat Breastworks	Military
Price	42Cb0138	Prehistoric
Price	42Cb0144	Prehistoric
Price	42Cb0146	Prehistoric
Price	42Cb0230	Prehistoric
Price	42Cb0240	Prehistoric
Price	42Cb0264	Prehistoric

Closest City	**Site Name**	**Type of Site**
Price	42Cb0593	Prehistoric
Price	42Cb0594	Prehistoric
Price	42Cb0628	Prehistoric
Price	42Cb0629	Prehistoric
Price	42Cb0630	Prehistoric
Price	42Cb0632	Prehistoric
Price	42Cb0637	Prehistoric
Price	42Cb0641	Prehistoric
Price	42Cb0668	Prehistoric
Price	42Cb0676	Prehistoric
Price	42Cb0678	Prehistoric
Price	42CB0680	Prehistoric
Price	42Cb0693	Prehistoric
Price	42Cb0695	Prehistoric
Price	42Cb0696	Prehistoric
Price	42Cb0698	Prehistoric
Price	42Cb0700	Prehistoric
Price	42Cb0701	Prehistoric
Price	42Cb0702	Prehistoric
Price	42Cb0703	Prehistoric
Price	42Cb0704	Prehistoric
Price	42Cb0705	Prehistoric
Price	42Cb0707	Prehistoric
Price	42Cb0708	Prehistoric
Price	42Cb0709	Prehistoric
Price	42Cb0712	Prehistoric
Price	42Cb0713	Prehistoric
Price	42Cb0714	Prehistoric
Price	42Cb0715	Prehistoric
Price	42Cb0718	Prehistoric
Price	42Cb0734	Prehistoric
Price	42Cb0735	Prehistoric
Price	42Cb0742	Prehistoric
Price	42Cb0747	Prehistoric
Price	42Cb0749	Prehistoric
Price	42Cb0750	Prehistoric
Price	42Cb0751	Prehistoric
Price	42Cb0752	Prehistoric
Price	42Cb0753	Prehistoric
Price	42Cb0754	Prehistoric
Price	42Cb0755	Prehistoric
Price	42Cb0756	Prehistoric

Closest City	Site Name	Type of Site
Price	42Cb0757	Prehistoric
Price	42Cb0758	Prehistoric
Price	42Cb0759	Prehistoric
Price	42Cb0760	Prehistoric
Price	42Cb0761	Prehistoric
Price	42Cb0766	Prehistoric
Price	42Cb0767	Prehistoric
Price	42Cb0769	Prehistoric
Price	42Cb0771	Prehistoric
Price	42Cb0775	Prehistoric
Price	42Cb0776	Prehistoric
Price	42Cb0777	Prehistoric
Price	42Cb0778	Prehistoric
Price	42Cb0779	Prehistoric
Price	42Cb0780	Prehistoric
Price	42Cb0781	Prehistoric
Price	42Cb0783	Prehistoric
Price	42Cb0787	Prehistoric
Price	42Cb0788	Prehistoric
Price	42Cb0790	Prehistoric
Price	42Cb0791	Prehistoric
Price	42Cb0792	Prehistoric
Price	42Cb0794	Prehistoric
Price	42Cb0802	Prehistoric
Price	42Cb0803	Prehistoric
Price	42Cb0806	Prehistoric
Price	42Cb0807	Prehistoric
Price	42Cb0808	Prehistoric
Price	42Cb0810	Prehistoric
Price	42Cb0812	Prehistoric
Price	42Cb0813	Prehistoric
Price	42Cb0814	Prehistoric
Price	42Cb0825	Prehistoric
Price	42Cb0829	Prehistoric
Price	42Cb0831	Prehistoric
Price	42Cb0832	Prehistoric
Price	42Cb0834	Prehistoric
Price	42Cb0859	Prehistoric
Price	42Cb0863	Prehistoric
Price	42Cb0866	Prehistoric
Price	42Cb0867	Prehistoric
Price	42Cb0868	Prehistoric

Closest City	**Site Name**	**Type of Site**
Price	42Cb0869	Prehistoric
Price	42Cb0870	Prehistoric
Price	42Cb0872	Prehistoric
Price	42Cb0875	Prehistoric
Price	42Cb0877	Prehistoric
Price	42Cb0880	Prehistoric
Price	42Cb0881	Prehistoric
Price	42Cb0882	Prehistoric
Price	42Cb0883	Prehistoric
Price	42Cb0884	Prehistoric
Price	42Cb0885	Prehistoric
Price	42Cb0886	Prehistoric
Price	42Cb0888	Prehistoric
Price	42Cb0889	Prehistoric
Price	42Cb0890	Prehistoric
Price	42Cb0891	Prehistoric
Price	42Cb0892	Prehistoric
Price	42Cb0894	Prehistoric
Price	42Cb0895	Prehistoric
Price	42Cb0896	Prehistoric
Price	42Cb0898	Prehistoric
Price	42Cb0899	Prehistoric
Price	42Cb0900	Prehistoric
Price	42Cb0911	Prehistoric
Price	42Cb0912	Prehistoric
Price	42Cb0919	Prehistoric
Price	42Cb0920	Prehistoric
Price	42Cb0921	Prehistoric
Price	42Cb0922	Prehistoric
Price	42Cb0923	Prehistoric
Price	42Cb0924	Prehistoric
Price	42Cb0955	Prehistoric
Price	42Cb0956	Prehistoric
Price	42Cb0970	Prehistoric
Price	42Cb0971	Prehistoric
Price	42Cb0972	Prehistoric
Price	42Cb0973	Prehistoric
Price	42Cb0975	Prehistoric
Price	42Cb0976	Prehistoric
Price	42Cb0977	Prehistoric
Price	42Cb0981	Prehistoric
Price	42Cb0982	Prehistoric

Closest City	Site Name	Type of Site
Price	42Cb0983	Prehistoric
Price	42Cb0984	Prehistoric
Price	42Cb0985	Prehistoric
Price	42Cb0986	Prehistoric
Price	42Cb0994	Prehistoric
Price	42Cb1045	Prehistoric
Price	42Cb1046	Prehistoric
Price	42Cb1047	Prehistoric
Price	42Cb1048	Prehistoric
Price	42Cb1049	Prehistoric
Price	42Cb1050	Prehistoric
Price	42Cb1051	Prehistoric
Price	42Cb1252	Prehistoric
Price	42Cb1379	Prehistoric
Price	42Cb145	Prehistoric
Price	42Cb1466	Prehistoric
Price	42Cb1756	Prehistoric
Price	42Cb1757	Prehistoric
Price	42Cb1758	Prehistoric
Price	42Cb2005	Prehistoric
Price	42Cb2006	Prehistoric
Price	42Cb2007	Prehistoric
Price	42Cb2008	Prehistoric
Price	42Cb2009	Prehistoric
Price	42Cb2018	Prehistoric
Price	42Cb2019	Prehistoric
Price	42Cb2023	Prehistoric
Price	42Cb2024	Prehistoric
Price	42Cb2025	Prehistoric
Price	42Cb2028	Prehistoric
Price	42Cb2043	Prehistoric
Price	42Cb2218	Prehistoric
Price	42Cb2231	Prehistoric
Price	42Cb242	Prehistoric
Price	42Cb2766	Prehistoric
Price	42Cb31	Prehistoric
Price	42Cb33	Prehistoric
Price	42Cb36	Prehistoric
Price	42Cb46	Prehistoric
Price	42Cb48	Prehistoric
Price	42Cb50	Prehistoric
Price	42Cb51	Prehistoric

Closest City	Site Name	Type of Site
Price	42Cb52	Prehistoric
Price	42Cb690	Prehistoric
Price	42Cb697	Prehistoric
Price	42Cb729	Prehistoric
Price	42Cb730	Prehistoric
Price	42Cb731	Prehistoric
Price	42Cb736	Prehistoric
Price	42Cb743	Prehistoric
Price	42Cb744	Prehistoric
Price	42Cb745	Prehistoric
Price	42Cb746	Prehistoric
Price	42Cb804	Prehistoric
Price	42Cb809	Prehistoric
Price	42Cb811	Prehistoric
Price	42Cb851	Prehistoric
Price	42Cb893	Prehistoric
Price	42Cb969	Prehistoric
Price	42Cb974	Prehistoric
Price	42Dc706	Prehistoric
Price	Cottonwood Village	Prehistoric
Price	Drop-Dead Ruin	Prehistoric
Price	First Canyon Site	Historic - Aboriginal, Prehistoric
Price	Flat Canyon Archeological District	Prehistoric
Price	42Dc0331	Prehistoric
Price	42Dc0530	Prehistoric
Price	42Dc0645	Prehistoric
Price	42Dc1302	Prehistoric
Price	42Dc1618	Prehistoric
Price	42Dc1619	Prehistoric
Price	42Dc1620	Prehistoric
Price	42Dc306	Prehistoric
Price	42Dc638	Prehistoric
Price	42Dc682	Prehistoric
Price	42Dc683	Prehistoric
Price	42Dc684	Prehistoric
Price	42Dc685	Prehistoric
Price	42Dc686	Prehistoric
Price	42Dc687	Prehistoric
Price	42Dc688	Prehistoric
Price	42Dc696	Prehistoric
Price	42Dc700	Prehistoric
Price	42Dc702	Prehistoric

Closest City	Site Name	Type of Site
Price	42Dc703	Prehistoric
Price	42Dc704	Prehistoric
Price	42Dc705	Prehistoric
Price	42Dc708	Prehistoric
Price	42Dc709	Prehistoric
Price	42Dc710	Prehistoric
Price	42Dc712	Prehistoric
Price	Centennial House	Prehistoric
Price	Fool's Pinnacle	Prehistoric
Price	Karen's Cist	Prehistoric
Price	Maxies Pad	Prehistoric
Price	Nordell's Fort	Prehistoric
Price	Redman Village	Prehistoric
Price	Sunstone Village	Prehistoric
Price	Taylor's City	Prehistoric
Salina	Aspen-Cloud Rock Shelters	Prehistoric
Salina	Fish Lake Cut-off of the Old Spanish Trail Archeological District, Red Creek--Sheep Valley Seg. Fishlake National Forest	Historic
Salina	Gooseberry Valley Archeological District	Prehistoric
Salina	Old Spanish Trail Archeological District, Ivie Creek--Emigrant Pass Segment, Fishlake National Forest	Historic
Salina	Sudden Shelter (42SV6)	Prehistoric
Scipio	Pharo Village	Prehistoric
South Jordan	Doggy Door Tie Cutter Cabin	Historic
Springdale	Parunuweap Canyon Archeological District	Historic - Aboriginal, Prehistoric
Stockton	Soldier Creek Kilns	Historic
Summit	Evans Mound (42IN40)	Prehistoric
Thompson	Thompson Wash Rock Art District	Historic - Aboriginal, Prehistoric
Vernal	Little Brush Creek Petroglyphs	Prehistoric
Washington	Southern Paiute Archeological District	Prehistoric
Wendover	Danger Cave	Historic - Aboriginal, Prehistoric
Whiterocks	Whiterocks Village Site	Prehistoric

Source: (NPS, 2014e)

16.1.11.7. Historic Context

European exploration of what is now Utah began when the Spanish explorer, Francisco Vazquez de Coronado entered the southern part of the state in 1540. Later, Juan Maria Rivera entered the region in 1765. In 1776, a Spanish missionary group (the Dominguez-Escalante Expedition) traveled into Utah, but turned back before reaching their destination in California. These early groups did some of the first mapping of the area, which aided subsequent exploration attempts.

Fur trappers and traders began to move into Utah during the late 18th century, continuing to do so until settlement commenced in the 1840s (Rood, R.; Thatcher, L., 2015a).

Mormons were instrumental in the settlement of Utah, first arriving in the Great Basin in 1847 and forming what is now Salt Lake City. The Mormons had decided to move west from Illinois after the murder of Joseph Smith, and were solicited to fight for the United States following outbreak of the Mexican-American War (Rood, R.; Thatcher, L., 2015b). Utah became a U.S. territory following the conclusion of the Mexican-American War, and the Mormons, led by Brigham Young, attempted to establish an officially recognized Mormon territory. The U.S. Federal Government refused to recognize the Mormon claim, and created the Territory of Utah in 1850 (Rood, R.; Thatcher, L., 2015c).

The Mormon practice of polygamy affected national politics, and ultimately hindered the process of statehood for Utah until the late 19th century. Armed conflict during the late 1850s caused the president to send troops to subdue the Mormons. While Utah was not directly involved in the Civil War, the issue of slavery in the territory was contested leading up to the conflict (Rood, R.; Thatcher, L., 2015c). During the latter part of the 1860s, a railroad was completed through the area, lessening the Mormon's ability to remain isolated, and sparking further development in the region (Rood, R.; Thatcher, L., 2015d).

Mining grew in importance in the 1860s, but primarily among non-Mormons due to the discouragement of Brigham Young. Ultimately, this allowed others outside of the majority Mormon population to gain wealth and influence, and have more of a say in the governance of the territory (Rood, R.; Thatcher, L., 2015e). Urbanization began to occur in the 1860s and 1870s, but largely among the non-Mormon population, as Mormons were encouraged to settle in rural areas and focus on farming. In 1877, Brigham Young died, after having dominated Utah politics since settlement (Rood, R.; Thatcher, L., 2015f). Utah remained a territory until January 4, 1896, at which point it was admitted to the Union as the 45th state (Rood, R.; Thatcher, L., 2015g).

During World War I (WWI), Utah aided in the war effort, which helped grow the economy of the state. Following the war, labor union activity increased, accompanied by conflict with owners in the mining industry that sometimes resulted in violence. During the Great Depression, Utah faced widespread unemployment in both the agriculture and mining industries. Residents of the state participated in various New Deal work programs, which aided recovery, but did not experience a full recovery until World War II (WWII). During WWII, Utah produced food and materials for the war, including uranium,[118] and also hosted prisoner of war and internment camps, one of which held Japanese Americans who were thought to be a potential threat to national security following the attack at Pearl Harbor (Rood, R.; Thatcher, L., 2015h).

[118] Between 1944 and 1986, more than four million tons of uranium was mined from Navajo tribal lands in Utah, Arizona, and New Mexico. As of 2014, USEPA has documented more than 500 abandoned uranium mines (AUMs) and mills, half of which are emitting gamma radiation more than 10 times above background levels, and present a range of health risks to current residents (USEPA, 2014c). Impacts of AUMs in Utah are discussed in Section 16.1.14.4.

Utah has 1,818 National Register of Historic Places (NRHP) listed sites, as well as 14 National Historic Landmarks (NHL) (NPS, 2015c). Utah contains two National Heritage Areas (NHA), the Mormon Pioneer National Heritage Area, and the Great Basin National Heritage Route (NPS, 2015i). Figure 16.1.11-3 shows the location NRHP sites in Utah.

16.1.11.8. Architectural Context

Indigenous architecture still exists in the form of cliff dwellings constructed by the Anasazi, dating back 700 years (Rood, R.; Thatcher, L., 2015i). Indigenous architecture also included “wickiups” and “hogan” houses. Hogan houses, built by the Navajo, are usually made of logs and mud, and have recently seen a resurgence (Rood, R.; Thatcher, L., 2015j). Non-indigenous architecture of the early European contact period varied depending location, but dugout houses were common, as they required less material to construct. Dugouts were sunken into the ground, or built into hillsides, and were constructed of stone, logs, or earth. Single-cell, hall-parlor, double-cell, and central passage houses were common from settlement through the beginning of the 20th century (Utah Division of State History, 2015a).

During the 20th century, residential housing types included Foursquares, bungalows, revival housing, minimal traditional houses, and cottages, similar to other regions of the United States. An additional type, which was less common elsewhere in the country, was the “basement house.” Basement houses were essentially a revival of the dugout house that was built between the 1920s and 1950s. These houses were sunken approximately six feet into the ground, with walls rising three to four feet above ground, and were covered by a pitched or flat roof. These houses were also called “hope houses” because the residents hoped to expand upwards at a future date (Utah Division of State History, 2015b).

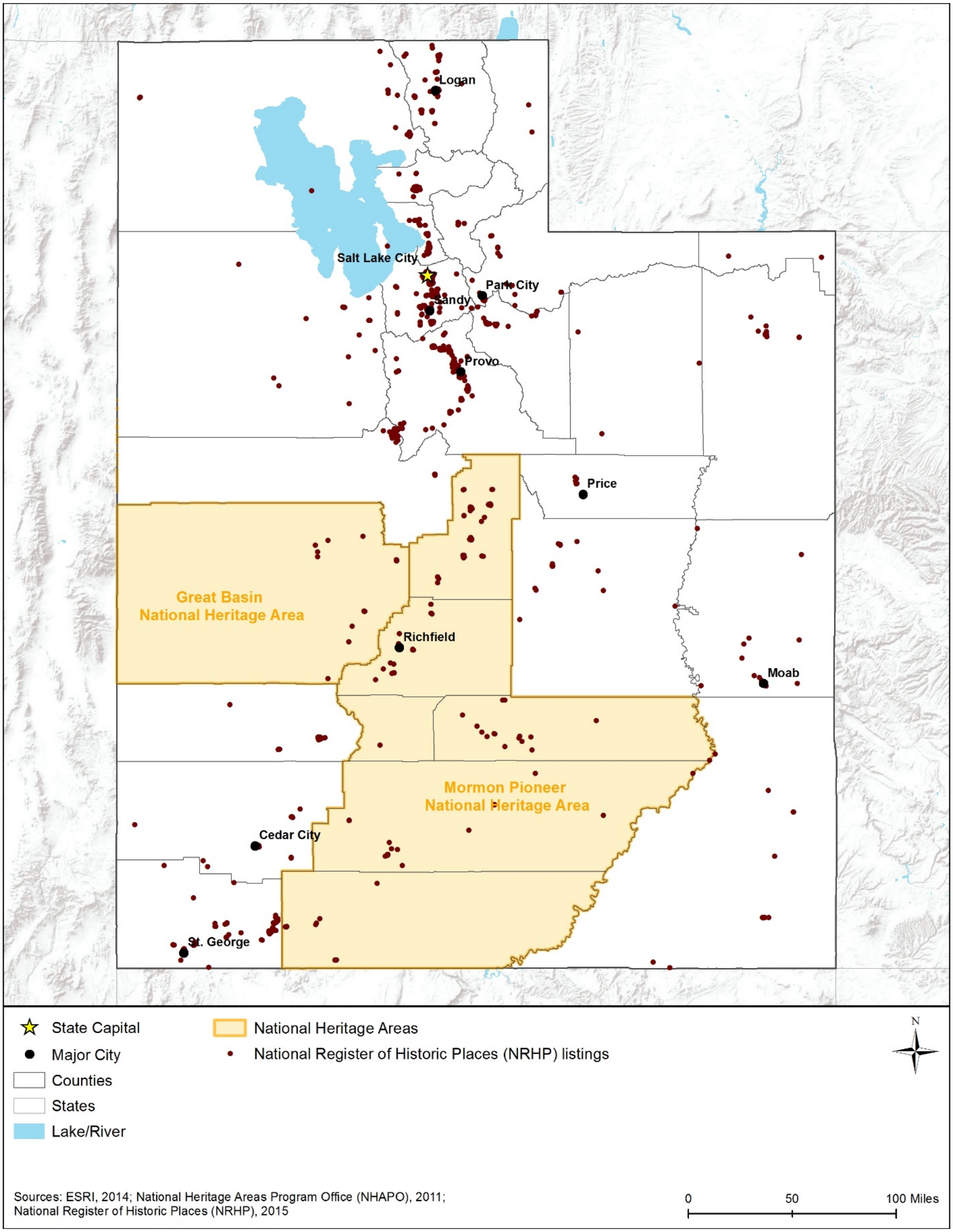

Figure 16.1.11-3: National Heritage Area (NHA) and National Register of Historic Places (NRHP) Sites in Utah

House styles reflected popular national trends, but often appeared later than in eastern states. The Federal style was built through the middle of the 1860s, with Greek Revival lasting nearly through the 19th century; both date ranges are later than in eastern states (Utah Division of State History, 2015c). Gothic Revival, Italianate, and Second Empire were built during the second half of the 19th century, with Victorian styles like Queen Anne, Stick, Richardsonian Romanesque, and others lasting into the 20th century. (Utah Division of State History, 2015d) (Utah Division of State History, 2015e). Craftsman and Prairie styles were built during the early 20th century, along with revival styles like Tudor and Spanish Revival (Utah Division of State History, 2015f) (Utah Division of State History, 2015g). During the pre-WWII years, modern styles such as Art Deco, Art Moderne, and International were built, with Midcentury Modern becoming popular post-WWII (Utah Division of State History, 2015h) (Utah Division of State History, 2015i).

Nonresidential building types are equally significant to Utah's history. Commercial building types include one-part and two-part blocks, temple front, warehouses, service stations, and strip malls from the 1950s and 1960s (Utah Division of State History, 2015j). Utah was heavily involved in agriculture for much of its history, and while many building have been lost due to 20th century development, agricultural buildings remain common. English barns, intermountain barns (similar to a New England barn), improvement era barns, silos and granaries, and Quonset huts (barrel-roofed buildings from around WWII) are examples (Utah Division of State History, 2015k). Education facilities include 1-room schoolhouses from the 19th century, larger school block buildings from the late 19th and early 20th centuries, horizontal schools from the 1920s and 1930s, and modern schools from after WWII. Modern schools were often low to the ground with a horizontal orientation (Utah Division of State History, 2015l).

Religious buildings are common and are significant to the history of the state. Mormon meetinghouses were built early in the process establishing settlements, sometimes looking similar to large residences. Most early Mormon meetinghouses were constructed of adobe, with the size of newer structures growing over time. Mormon temples were common throughout the state, and serve a more prestigious purpose than meeting houses. As a result, temples are far more elaborate in design. Despite their dominance, Mormons were not the only religious group in Utah, with Protestant meetinghouses from the last quarter of the 19th century still present on the landscape, as are Jewish synagogues. Despite Catholicism being the first Christian religion to have a presence in Utah (under Spain in the 18th century), the earliest Catholic churches in Utah date to the late 19th century (Utah Division of State History, 2015m).

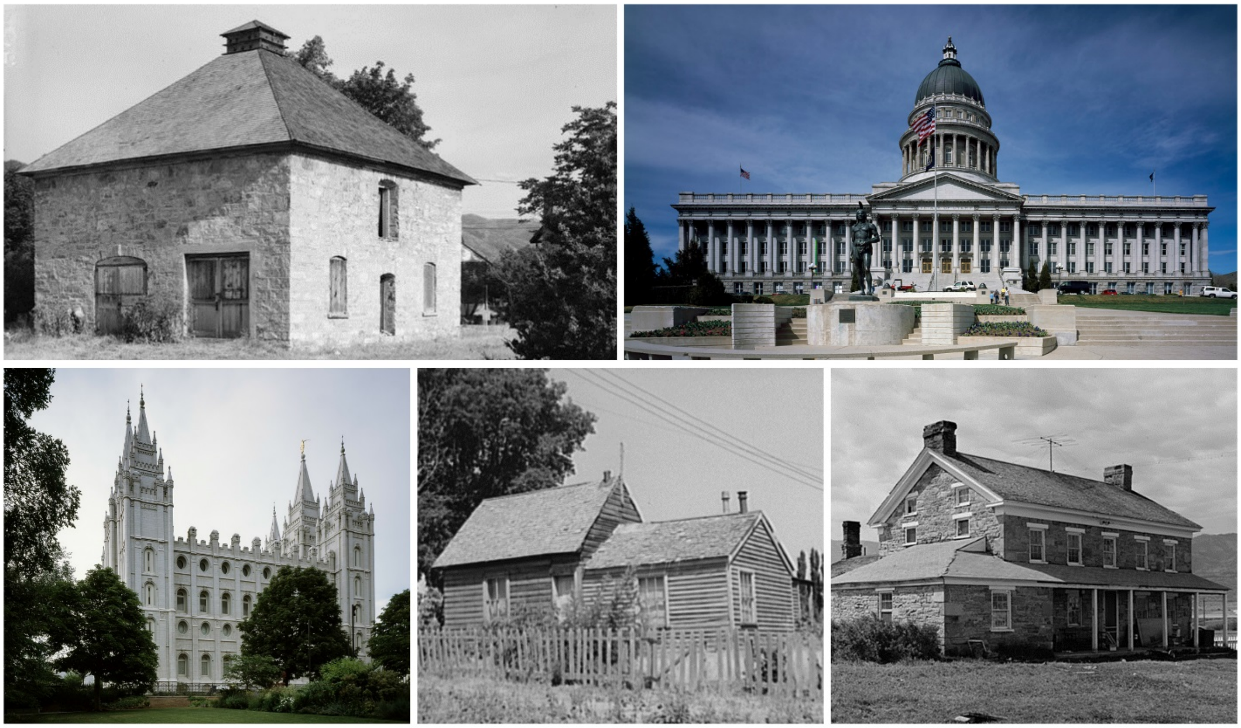

Figure 16.1.11-4: Representative Architectural Styles of Utah

Top Left – Logan Temple Barn (Logan, UT) – (Historic American Buildings Survey, 1933a)
Top Right – Utah State Capitol (Salt Lake City, UT) – (Highsmith, Capitol building, Salt Lake City, Utah, 1980a)
Bottom Left – Mormon Temple (Salt Lake City, UT) – (Highsmith, Mormon Temple, Salt Lake City, Utah, 1980b)
Bottom Middle – Old Mormon Farm House (Mendon, UT) – (Lee, 1940)
Bottom Right – Kimball Hotel (Silver Creek Junction, UT) – (Historic American Buildings Survey, 1933b)

16.1.12. Air Quality

16.1.12.1. 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[119] 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)[120] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[121] This section discusses the existing air quality in Utah. The USEPA designates areas within the United States as attainment,[122]

[119] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[120] Equivalent to 1 milligram per liter (mg/L).
[121] 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, 2015k).
[122] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015w).

nonattainment,[123] maintenance,[124] or unclassifiable[125] 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.

16.1.12.2. 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 (SO2). The NAAQS establish various standards, either primary[126] or secondary,[127] 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. Utah has adopted the NAAQS and does not maintain separate ambient air quality standards (UDEQ, 2016b).

In addition to the NAAQS, there are standards for hazardous air pollutants (HAP), which are those typically associated with specific industrial processes such as chromium electroplating (hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated solvents) (USEPA, 2016c). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air 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.

Title V Operating Permits/State Operating Permits

Utah 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, 2015o). The overall goal of the Title V program is to “reduce violations of air pollution laws and improve enforcement of those laws” (USEPA, 2015o). Utah Administrative Code R307-415-4 describes the applicability of Title V

[123] 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, 2015w).
[124] 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, 2015w).
[125] 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, 2015w).
[126] Primary standard: The primary standard is set to provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly (USEPA, 2014d).
[127] Secondary standards: The secondary standard is set to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USEPA, 2014d).

operating permits. Utah 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 16.1.12-1). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 16.1.12-1: Major Air Pollutant Source Thresholds

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

Source: (USEPA, 2014b)

Exempt Activities

Utah Air Quality Rules R307-401-9 identifies small stationary sources as exempt from the requirement to submit a notice of intent to obtain an approval order prior to construction, "if the following conditions are met:

- Its actual emissions are less than five tons per year per air pollutant of any of the following air pollutants: sulfur dioxide, carbon monoxide, nitrogen oxides, PM_{10}, ozone, or volatile organic compounds;
- Its actual emissions are less than 500 pounds per year of any hazardous air pollutant and less than 2000 pounds per year of any combination of hazardous air pollutants; and
- Its actual emissions are less than 500 pounds per year of any air pollutant not listed in [the bullets] above and less than 2000 pounds per year of any combination of air pollutant not listed in [the bullets] above." (UDEQ, 2016b)

Utah Air Quality Rules R307-401-10 identifies the following source categories as exempt from the requirement to submit a notice of intent to obtain an approval order prior to construction:

- "Fuel-burning equipment in which combustion takes place at no greater pressure than one inch of mercury above ambient pressure with a rated capacity of less than five million BTU per hour using no other fuel than natural gas or LPG or other mixed gas that meets the standards of gas distributed by a utility in accordance with the rules of the Public Service Commission of the State of Utah, unless there are emissions other than combustion products…
- Comfort heating equipment such as boilers, water heaters, air heaters and steam generators with a rated capacity of less than one million BTU per hour if fueled only by fuel oil numbers 1 - 6;
- Emergency heating equipment, using coal or wood for fuel, with a rated capacity less than 50,000 BTU per hour; [and]
- "Exhaust systems for controlling steam and heat that do not contain combustion products." (UDEQ, 2016b)

Temporary Emissions Sources Permits

In accordance with Utah Air Quality Rule R307-415-6e, Utah issues operating permits for temporary sources relocated for no more than 180 working days in one calendar year. For terms longer than 180 days, a permit modification (under Utah Air Quality Rules R307-415-7f) is required. (UDEQ, 2016b)

State Preconstruction Permits

Under Utah Air Quality Rules R307-401-3, any new installation with the potential "to become a source or an indirect source of air pollution," or any modification/relocation of an existing installation that might change the amount or effect of the air pollutants discharged from that installation, is required to submit a notice of intent and obtain an approval order prior to construction (UDEQ, 2016b).

General Conformity

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

The estimated pollutant emissions are compared to *de minimis*[128] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 16.1.12-2). As a result, lower *de minimis* thresholds for VOCs and NO_X could apply depending on the attainment status of a county.

Table 16.1.12-2: *De Minimis* Levels

Pollutant	Area Type	TPY
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
	Other areas outside an OTR	100
Ozone (NO_X)	Maintenance	100
Ozone (VOC)	Maintenance outside an OTR	100
CO, SO_2, NO_2	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ (Direct Emissions)	All Nonattainment and Maintenance	100

[128]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, 2016g)

Pollutant	Area Type	TPY
(SO_2) (NO_X (unless determined not to be a significant precursor)) (VOC or ammonia (if determined to be significant precursors))		
Lead	All Nonattainment and Maintenance	25

Source: (U.S. Government Publishing Office, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 16.1.12-2, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 16.1.12-2, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity,[129] 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 Utah SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Utah's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Utah's SIP actions are codified under 40 CFR Part 52 Subpart TT. A list of all SIP actions for all six criteria pollutants can be found on UDEQ's website: http://www.deq.utah.gov/Laws_Rules/daq/sip/sections.htm.

16.1.12.3. 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 16.1.12-1 and Table 16.1.12-3, below, present the nonattainment areas in Utah as of January 30, 2015. Table

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

16.1.12-3 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., CO, PM_{10}, $PM_{2.5}$, and SO_2). Unlike Table 16.1.12-3, Figure 16.1.12-1 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.

Table 16.1.12-3: Utah Nonattainment and Maintenance Areas by Pollutant Standard and County

County	Pollutant and Year USEPA Implemented Standard										
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$		O_3		SO_2	
County	**1971**	**1978**	**2008**	**1971**	**1987**	**1997**	**2006**	**1997**	**2008**	**1971**	**2010**
Box Elder							X-4				
Cache							X-4				
Davis							X-4				
Salt Lake	M				X-4		X-4			X-6	
Tooele							X-4			X-6	
Utah	M				X-4		X-4				
Weber	M				X-4		X-4				

Source: (USEPA, 2015i)

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

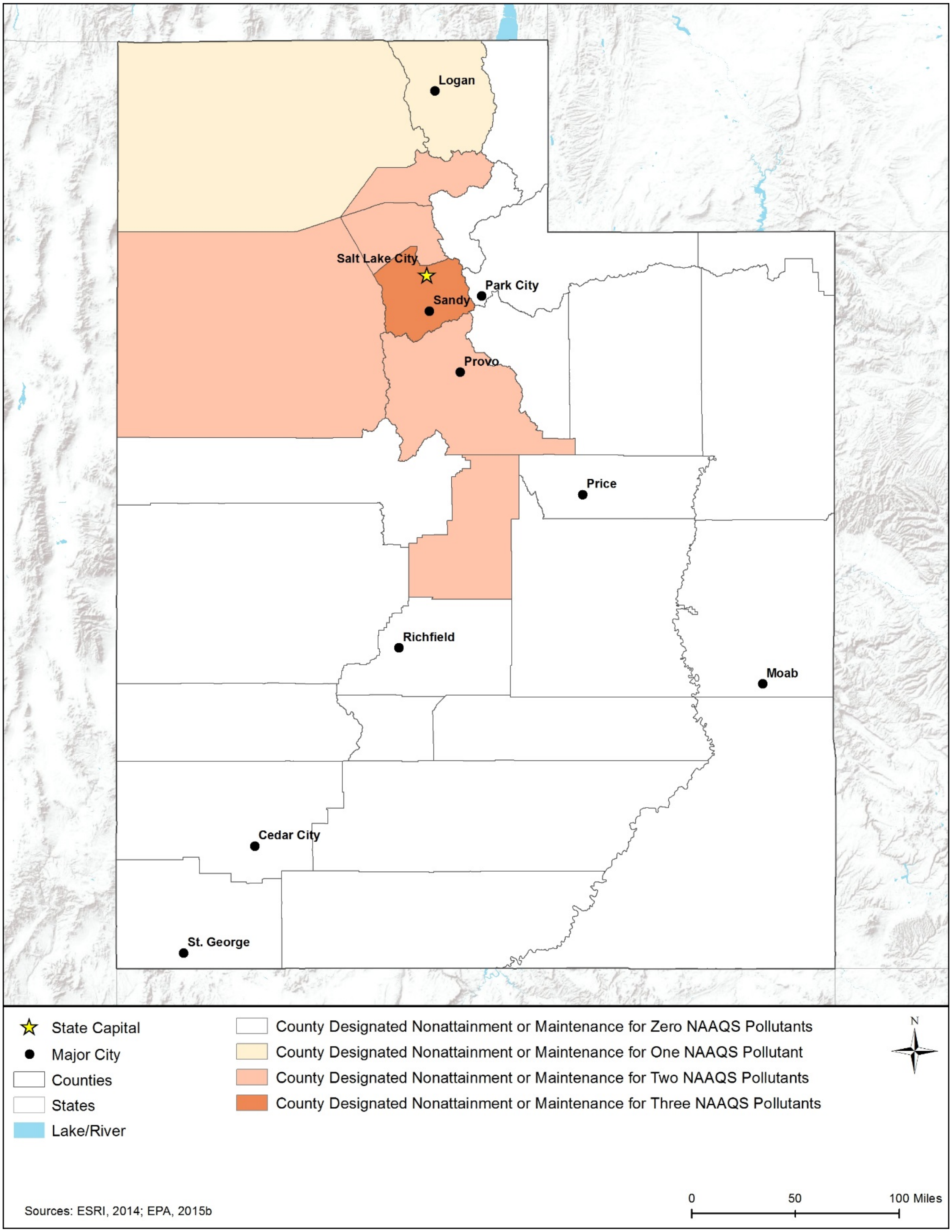

Figure 16.1.12-1: Nonattainment and Maintenance Counties in Utah

Air Quality Monitoring and Reporting

The Utah Department of Environmental Quality measures air pollutants at 20 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Annual Utah State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. Utah Department of Environmental Quality reports real-time pollution levels of $PM_{2.5}$ and O_3 on their website.

Throughout 2014, O_3 measurements exceeded the federal standard of 0.075 ppm four times at Spanish Fork (Utah County), and one time at Brigham City (Box Elder County), Hawthorne (Salt Lake City County), and Harrisville (Weber County) in Utah. That same year, $PM_{2.5}$ measurements exceeded the federal standard of 35 $\mu g/m^3$ over 50 times, including 13 times each at Hawthorne (Salt Lake City County) and Rose Park (Salt Lake City County), and 11 times at Logan #4 (Cache County). (UDEQ, 2015m)

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).(USEPA, 2013b).

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

- PSD applies to new major sources or major modifications at existing sources for pollutants where the source is in an attainment or unclassifiable area. 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 USEPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the point of significant impact or the source or 50 kilometers[131] (the normal useful range of USEPA-approved Gaussian plume models” (USEPA, 1992).

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

Utah Air Quality Rules R307-405-4 designates five federal Class I areas in Utah: Arches National Park, Bryce Canyon National Park, Canyonlands National Park, Capitol Reef National Park, and Zion National Park. The remaining land within the state is classified as Class II (UDEQ, 2016b). If an action is considered a major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (USEPA, 1992). Arizona and Colorado have Class I areas where the 100-kilometer buffer intersects a few Utah counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 16.1.12-2 provides a map of Utah 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 16.1.12-2 correspond to the numbers and Class I areas listed in Table 16.1.12-4.

Table 16.1.12-4: Relevant Federal Class I Areas

#[a]	Area	Acreage	State
1	Zion National Park	142,462	UT
2	Capitol Reef National Park	221,896	UT
3	Canyonlands National Park	377,570	UT
4	Bryce Canyon National Park	35,832	UT
5	Arches National Park	65,098	UT
6	Grand Canyon National Park	1,176,913	AZ
7	Mesa Verde National Park	51,488	CO

Source: (USEPA, 2012a)
[a] The numbers correspond to the shaded regions in Figure 16.1.12-2.

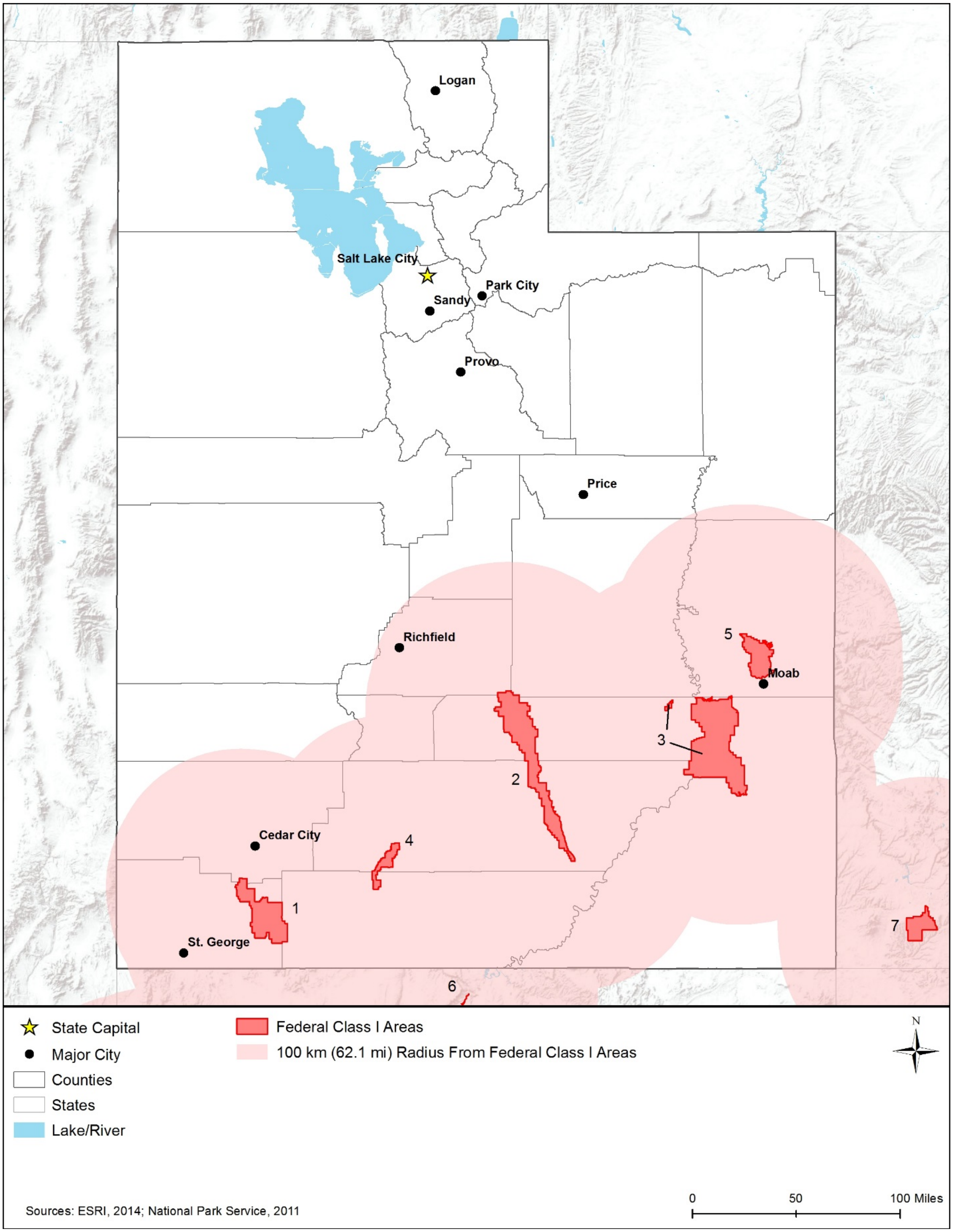

Figure 16.1.12-2: Federal Class I Areas with Implications for Utah

16.1.13. Noise

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

16.1.13.1. 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, 2015c). 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 16.1.13-1 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.

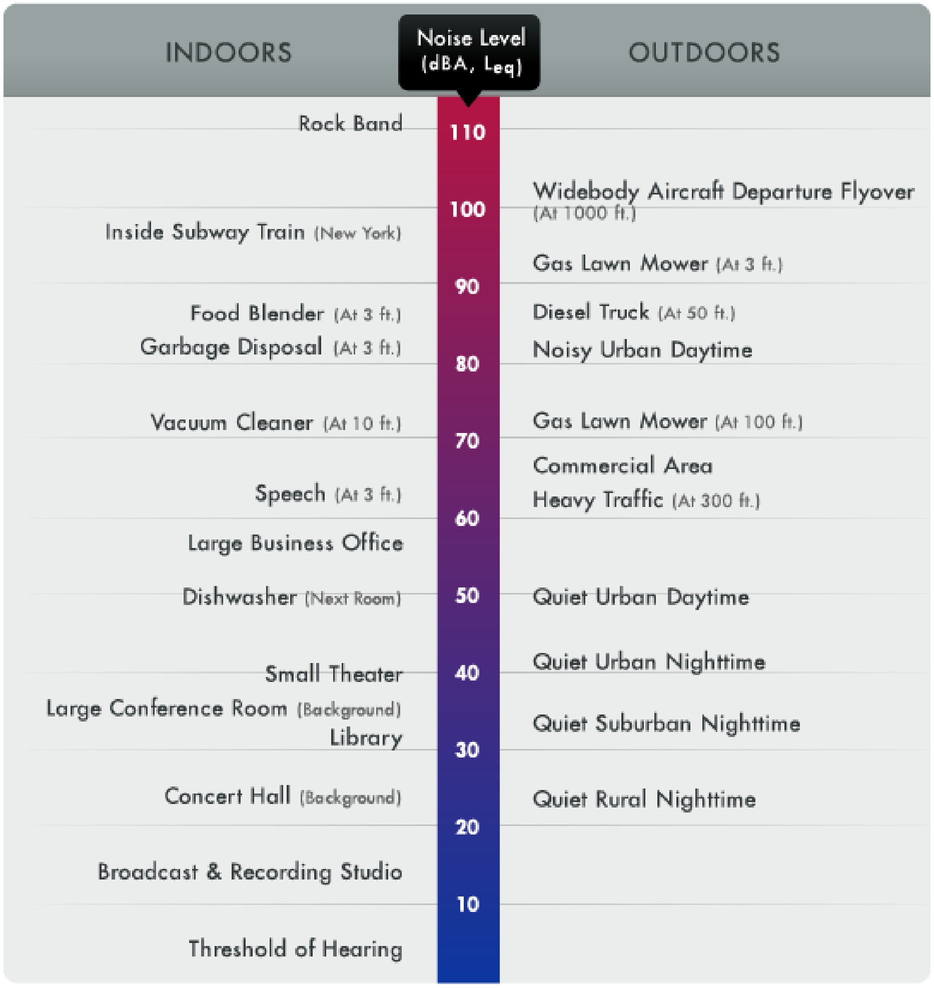

Figure 16.1.13-1: Sound Levels of Typical Sounds

Prepared by Booz Allen Hamilton

Source: (USFWS, 2013i)

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.

16.1.13.2. Specific Regulatory Considerations

As identified in Appendix C, the Noise Control Act of 1972, along with its subsequent amendments (e.g., Quiet Communities Act of 1978 [42 U.S.C. Parts 4901−4918]), delegates authority to the states to regulate environmental noise and directs government agencies to comply with local community noise statutes and regulations. Although no federal noise regulations exist, the USEPA has promulgated noise guidelines (USEPA, 1974). Similarly, most states have no quantitative noise-limit regulations.

Utah has several statewide noise regulations written into the Utah Code that mainly apply to motor vehicle functions, such as mufflers and horns. Table 16.1.13-1 provides a brief summary of these regulations.

Table 16.1.13-1: Relevant Utah Noise Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
41-6a-1625	Utah State Legislature	Requires motor vehicles operating on highways to be equipped with a horn or warning device in good working order.
41-6a-1626	Utah State Legislature	Requires vehicles to be equipped and operated with a maintained noise muffler.

Source: (Utah State Legislature, 2015e) (Utah State Legislature, 2015c) (Utah State Legislature, 2015d)

Many cities and towns may have additional, local noise ordinances to further manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Large cities and towns, such as Salt Lake City, Ogden, and Provo, 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).

16.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in Utah varies widely based on the area and environment of the area. The population of Utah can choose to live and interact in areas that are large cities, suburban neighborhoods, rural communities, and national and state parks. Figure 16.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Utah may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Utah. As such, this section describes the areas where the population of Utah 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 (80 to 100 dBA), construction noise (93 to 108 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA). The urban areas that are likely to have the highest ambient noise levels in the state are Salt Lake City, Ogden, and Provo.

- **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 exposure from aircraft operations (arrivals/departures) to the surrounding areas at higher levels and with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In Utah, Salt Lake City International Airport (SLC) has annual operations of more than 286,000 flights (Salt Lake City International Airport, 2016). These operations result in increased ambient noise levels in the surrounding communities. See Section 16.1.1, Infrastructure, and Figure 16.1.1-1 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 DOT, 2015). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living near those traffic corridors. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA DOT, 2015). See Section 16.1.1, Infrastructure, and Figure 16.1.1-1 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 (DOT, 2015). Utah has three passenger rail corridors with high levels of commercial and commuter rail traffic. The Utah section of the California Zephyr extends from Green River to Helper, Provo, and Salt Lake City. The Heber Valley Railroad extends from Heber City to Vivian Park in Provo Canyon. Finally, the Utah Transit Authority's Frontrunner provides commuter rail services that link Ogden with Salt Lake City (UDOT, 2015e). See Section 16.1.1, Infrastructure, and Figure 16.1.1-1for more information about rail corridors in the state.
- **National and State Parks:** The majority of national and state parks are likely to have lower than average ambient noise levels given their size and location in wilderness areas. National and state parks, historic areas, and monuments are protected areas, which are regions that are given legal safeguards in order to maintain biological diversity and natural resources (NPS, 2013a). These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014f). Utah has 13 National Park Service Units[132] and 4 National Natural Landmarks (NPS, 2015e). Visitors to these areas expect lower ambient noise conditions than the surrounding urban

[132] This count is based on the NPS website "by the numbers" current as of 9/30/2014 (NPS, 2015j). This number includes all NPS affiliated areas and units.

areas. See Section 16.1.8, Visual Resources, and Figure 16.1.8-3 for more information about national and state parks for Utah.

16.1.13.4. Sensitive Noise Receptors

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

16.1.14. Climate Change

16.1.14.1. 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, 2012d). 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[133] (MT CO_2e), which equalizes for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units are in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units are in MMT CO_2e.

The IPCC reports that global concentrations of 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).

[133] 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, 2015r).

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 16.2, 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.

16.1.14.2. Applicable Statutes and Regulations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C. Utah has not established goals and regulations to reduce GHG emissions to combat climate change. However, Salt Lake City, Utah has established its own goals and regulations as shown in Table 16.1.14-1; this is the primary policy driver on climate change preparedness and GHG emissions in the state's capital.

Table 16.1.14-1: Relevant Utah Climate Change Laws and Regulations

State Laws/Regulations	Regulatory Agency	Applicability
Climate Change Planning	City of Salt Lake City	"In 2008, Mayor Ralph Becker and the Salt Lake City Council signed a joint resolution committing that the City will work to reduce its carbon footprint: • 20 percent below the 2005 level by 2020; • 50 percent below the 2005 level by 2040; and, • 80 percent below the 2005 level by 2050" (Salt Lake City, 2015).

While there are no statewide climate change goals, Utah's Department of Health has released a report "Climate Change and Public Health in Utah," which was compiled to provide a better understanding of "how climate change can affect the health of Utah's citizens…[and]…presents climate-related public health indicators pertaining to disease outcomes, environmental pollution and weather to show trends that may be useful to support public discussion of the effects climate has on public health and policy." (Utah Department of Health, 2015a)

16.1.14.3. Greenhouse Gas Emissions

Estimates of Utah's total GHG emissions vary. The Department of Energy's (DOE) Energy Information Agency (EIA) collects and disseminates national-level emissions data on other GHGs such as methane (CH_4) and nitrous oxide (NO_x), but not at the state level (EIA, 2011). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (EPA, 2015). Individual states have developed their own GHG inventories, which are updated with different frequencies and trace GHG 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, Utah emitted a total of 66.4 MMT of CO_2 in 2013 from fossil fuels, an increase of 5.2 MMT over 2012. Just over fifty percent of CO_2 emissions come from the electric power sector, almost exclusively from coal with a small amount from natural gas (Table 16.1.14-1) (EIA, 2015b). Annual emissions between 1980 and 2012 are presented in Figure 16.2.14-1. Utah's CO_2 emissions decreased in the early 1980s before increasing sharply to a high of 70.0 MMT in 2007, then declining to their current level (Figure 16.2.14-1). Both increases and declines were led by emissions from coal. Recently emissions from natural gas have increased. Emissions from petroleum products have remained relatively constant. Utah ranked 31st in total CO_2 emissions among the 50 states and the District of Columbia in 2013, and ranked 17th in per capita emissions (EIA, 2015e).

Table 16.1.14-2: Utah CO_2 Emissions from Fossil Fuels by Fuel Type and Sector, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	33.5	Residential	4.1
Petroleum Products	19.1	Commercial	2.7
Natural Gas	13.7	Industrial	8.3
		Transportation	16.5
		Electric Power	34.9
Total	**66.4**	Total	**66.4**

Source: (EIA, 2015b)

The UDEQ commissioned the Center for Climate Change Strategies to prepare a greenhouse gas emissions inventory for the state of Utah. The baseline GHG emissions estimate for 1990 was 49.3 MMT CO_2e. From that level, GHG emissions increased to 68.8 MMT CO_2e in 2005. Forecasted emissions for 2010 and 2020 put total GHG emissions at 75.6 MMT CO_2e and 96.1 MMT CO_2e respectively. Energy production dominates Utah's GHG emissions profile as it does the CO_2 emissions profile: approximately 21 MMT of the increases between 2005 and 2020 were forecasted to come from the energy sector (UDEQ, 2007). For comparison, total U.S. GHG emissions were 6,673 million metric tons (14.7 trillion pounds) in 2013 (USEPA, 2015e).

The majority of Utah's GHG emissions are 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 Utah are CH_4, hydrofluorocarbons, NO_x, and a very small quantity of sulfur hexafluoride (SF_6) and perfluorocarbons (UDEQ, 2007).

Emissions in 2005 came from energy related activities across all sectors such residential (21.1 percent) commercial (19.7 percent) industrial (29.1 percent) transportation (30.1 percent). At 29.1 percent and 30.1 percent respectively, the industrial sector and the transportation sectors were the largest contributors of GHG emissions in Utah in 2013 (UDEQ, 2007), (USEPA, 2015e).

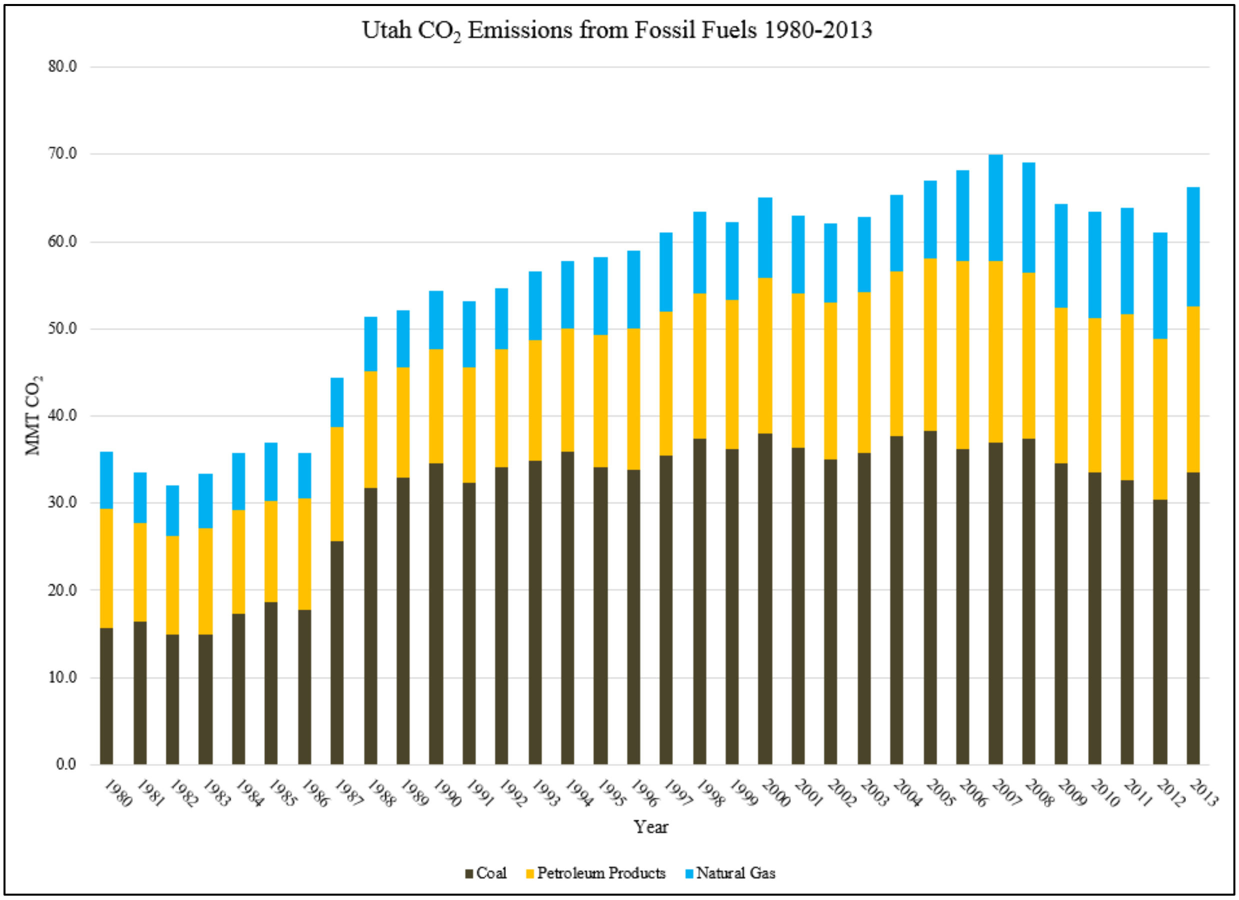

Figure 16.1.14-1: Utah CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Utah's electricity emissions continue to grow annually due to population and economic growth. Utah generates and exports a majority of its electricity to surrounding states, which is why Utah produces more electricity than it consumes. "In 2000, Utah exported 28 percent of the electricity produced in the State. As a result, in 2000, emissions associated with electricity consumption (22.5 MMt CO_2e) were much lower than those associated with electricity production (32.4 MMt CO_2e)" (UDEQ, 2007). Emissions from the transportation sector have risen by 45 percent between 1990 and 2005 at about three percent annually. These emissions are from gasoline-powered vehicles, diesel and air travel, marine gasoline and locomotives (UDEQ, 2007).

16.1.14.4. Environmental Setting: Existing Climate

The National Weather Service defines climate as the "reoccurring average weather found in any particular place" (NOAA, 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" (NOAA, 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 (NOAA, 2011b).

The majority of Utah falls into climate group (B) (see Figure 16.1.14-2). Climates classified as (B) are dry climates, “in large continental regions of the mid-latitudes often surrounded by mountains” (NWS, 2011a). “The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation” (NWS, 2011a). Although a majority of Utah is classified as climate group (B), areas of central and northern Utah are classified as climate group (D) and a small area in north central Utah is classified as climate group (C).

Climates classified as (D) are “moist continental mid-latitudinal climates,” with “warm to cool summers and cold winters” (NWS, 2011a). In (D) climates, the “average temperature of the warmest month is greater than 50 degrees Fahrenheit (°F), while the coldest month is less than negative 22 °F” (NWS, 2011a). Winter months in (D) climate zones are cold and severe with “snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses” (NWS, 2011a) (NWS, 2011b). Climates classified as (C), are generally warm, with humid summers and mild winters. During winter months, the main climatic feature is the mid-latitude cyclone. During winter months, thunderstorms are dominant. Utah has four sub-climate categories, which are described in the following paragraphs. (NWS, 2011a) (NWS, 2011b)

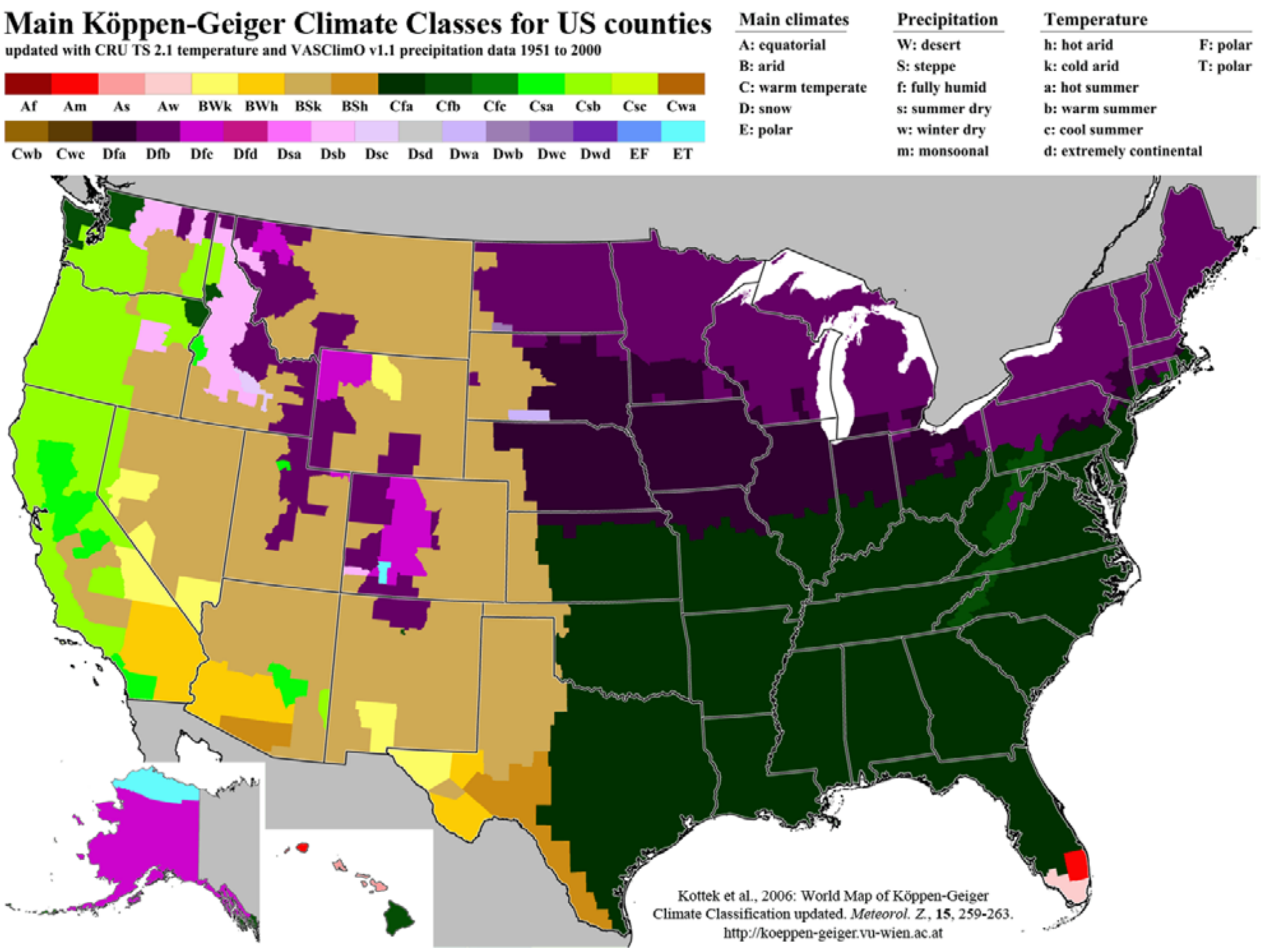

Figure 16.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, M., 2006)

Csa – The Köppen-Geiger climate classification system classifies a small area in north central Utah as Csa. Climates classified as Csa are warm, temperate climates with dry and hot summers. The coldest month in a Csa climate is typically warmer than 26.6 °F, but colder than 64.4 °F. Csa climates are typically found inland and on "western sides of continents" (GLOBE SRC, 2011). (NWS, 2011a) (NWS, 2011b)

Bsk – The Köppen-Geiger climate classification system classifies the majority of Utah as Bsk. Climates classified as Bsk, are mid-latitude and dry. "Evaporation exceed precipitation on average but is less than potential evaporation" (NWS, 2011b). Average temperatures in Bsk climate zones are less than 64 °F. (NWS, 2011a) (NWS, 2011b)

Dfb – The Köppen-Geiger climate classification system classifies portions of central and northern Utah as Dfb. Climates classified as Dfb are humid, continental climates with severe winters and warm summers. Dfb climate do not experience a dry season, with precipitation occurring throughout the year (NWS, 2011b). (GLOBE SRC, 2011)

Dfc – The Köppen-Geiger climate classification system classifies a small portion of northeastern Utah as Dfc. Climates classified as Dfc are snowy, fully humid climates, with cool summers. Precipitation accumulation is generally constant throughout the year in Dfc climates. (NWS, 2011a) (NWS, 2011b)

Air Temperature

The average temperature in Utah (1901 to 2014) is approximately 47.6 °F (NOAA, 2015a). The highest temperature to occur in Utah was on July 5, 1985 with a record high of 117 °F (SCEC, 2015). The lowest temperature to occur in Utah was on January 5, 1913 with a record low of negative 50 °F (SCEC, 2015).

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

Csa – Salt Lake City, in north central Utah, is within the climate classification zone Csa. The average annual temperature in Salt Lake City is 52.8 °F; 31.2 °F during winter months; 75.2 °F during summer months; 51.4 °F during spring months; and 53.0 °F during autumn months (NOAA, 2015b).

Bsk – St. George, in far southwestern Utah, is within the climate classification zone Bsk. The average annual temperature in St. George is 63.9 °F; 43.4 °F during winter months; 85.2 °F during summer months; 62.9 °F during spring months; and 63.9 °F during autumn months (NOAA, 2015b).

Dfb – Provo, in central Utah, is within the climate classification zone Dfb. The average annual temperature in Provo is 53.4 °F; 32.7 °F during winter months; 74.3 °F during summer months; 52.6 °F during spring months; and 53.7 °F during autumn months (NOAA, 2015b).

Dfc –Manila, in far northeastern Utah and along the border, is within the climate classification zone Dfc. The average annual temperature in Manila is 43.9 °F; 24.0 °F during winter months; 63.8 °F during summer months; 42.5 °F during spring months; and 45.1 °F during autumn months (NOAA, 2015b).

Precipitation

Precipitation varies across Utah, both seasonally and geographically. There is "considerable disparity in precipitation between the desert of southern Utah and a wetter northern Utah" (Davies, 2015). The state's western deserts annually receive less than five inches of rainfall. High altitude areas, such as the resort town of Alta, southeast of Salt Lake City, receive up to 500 inches of snowfall (approximately 50 inches of liquid equivalent) annually (Davies, 2015).

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

Csa – Salt Lake City, in north central Utah, is within the climate classification zone Csa. The average annual precipitation accumulation in Salt Lake City is 16.10 inches; 3.91 inches during winter months; 2.28 inches during summer months; 5.73 inches during spring months; and 4.18 inches during autumn months (NOAA, 2015b).

Bsk – St. George, in far southwestern Utah, is within the climate classification zone Bsk. The average annual precipitation accumulation in St. George is 8.80 inches; 3.49 inches during winter months; 1.41 inches during summer months; 1.94 inches during spring months; and 1.96 inches during autumn months (NOAA, 2015b).

Dfb – Provo, in central Utah, is within the climate classification zone Dfb. The average annual precipitation accumulation in Provo is 19.75 inches; 5.67 inches during winter months; 2.94 inches during summer months; 6.01 inches during spring months; and 5.13 inches during autumn months (NOAA, 2015b).

Dfc –Manila, in far northeastern Utah and along the border, is within the climate classification zone Dfc. The average annual precipitation accumulation in Manila is 9.14 inches; 0.96 inches during winter months; 3.06 inches during summer months; 2.99 inches during spring months; and 2.13 inches during autumn months (NOAA, 2015b).

Severe Weather Events

Utah experiences many forms of severe weather including, lightning, winter storms, heavy snow, flooding, and tornadoes.

Lightning in Utah can be particularly severe. Since 1950, 51 deaths and 131 injuries have occurred in Utah due to lightning. Lightning is Utah's "second deadliest natural hazard, trailing only avalanches" (State of Utah, 2014). The majority of lightning strikes in Utah occur during the summer months of May, June, July, and August, as these months are associated with large, consecutive thunderstorms (State of Utah, 2014). Utah's most severe lightning strike occurred on September 1939, in Box Elder County and killed 835 sheep (WRCC, 2015).

Severe winter storms are also common to Utah, with Utah's most severe winter storm since 1899 occurring during the winter of 1948. This storm produced some of Utah's coldest temperatures and highest snowfall totals on record. As a result, farmers across the state reported a 25 percent loss in livestock, "many fruit trees were killed, wildlife struggled, tourist trade reached an all time low, and 10 people died from exposure" to the elements (WRCC, 2015). During another major snowstorm event in 1993, heavy snow fell for a 6-day period in Salt Lake City, with a record storm total of 26 inches on the ground and approximately three feet on the eastern side of the valley. As a result, the Governor of Salt Lake City declared a state of emergency and "activated the Utah National Guard who assisted in snow removal" (WRCC, 2015).

Utah's most severe and deadly avalanche occurred in Bingham Canyon on February 17, 1926. This avalanche destroyed 14 mining cottages and a 3-story building, in addition to killing 36 people and injuring 13 others, "out of the 65 people that were in its path" (WRCC, 2015).

Utah's most severe tornado, classified as an F2 (113 to 157 mph) occurred on August 11, 1999. The tornado had an "average width of 100 to 200 years, carved a path 4.25 miles long, and was on the ground for 14 minutes" (WRCC, 2015). Although the majority of the damage was confined to Salt Lake City, more than 80 people were injured, 500 trees were damaged or destroyed, and approximately $170 million in damages were incurred as a result. (WRCC, 2015)

"The most severe and extensive snow melt flooding in the history of Utah occurred during the spring and early summer" of April through June in 1983 (WRCC, 2015). In addition to extensive snowmelt flooding, "a massive mudslide blocked the Spanish Fork River," just below the town of Thistle. As a result, the town of Thistle was "inundated and buried" beneath water and mud (WRCC, 2015). Between May and early June, record river flows were recorded on "five of the six creeks in the Salt Lake Valley" (WRCC, 2015). As a result, certain rivers were re-routed "along some of the major streets in downtown Salt Lake" (WRCC, 2015). Later in June, the Delta, Melville, Abraham, and Deseret Companies (DMAD) Dam failed, "completely inundating the town of Deseret" (WRCC, 2015). In total, these floods and mudslides resulted in approximately $300 million in damages. (WRCC, 2015)

During a more recent flooding event in 2005, an estimated 12-inches of rain fell in a 48-hour period over southwest Utah. As a result, the Santa Clara River reached "record flows of over 6,000 cubic feet per second" (NWS, 2015a). This flood caused "roughly $150 to $180 million" in damages, "with another $100 million possibly needed for river reclamation efforts" (NWS, 2015a).

16.1.15. Human Health and Safety

16.1.15.1. Definition of the Resource

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

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation or vehicular traffic. Vehicle traffic is evaluated in Section 16.1.1, Infrastructure.

16.1.15.2. Specific Regulatory Considerations

Federal organizations, such as OSHA, USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In Utah, this resource area is regulated by the Utah Labor Commission, Utah Occupational Safety and Health Division (UOSH) and the UDEQ. Federal OSH regulations apply to workers through either OSHA, or stricter state-specific plans that must be approved by OSHA. Utah's Public Employees Occupational Safety and Health State Plan has adopted all OSHA state and local government employment regulations except for standards regarding toxic chemical handling and exposure, agriculture, and child labor (OSHA, 2015a). Occupational safety regulations are enforced at the state level by UOSH and at the federal level by OSHA. Occupational and public health are regulated by the Utah Department of Health (UTDOH).

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C. Table 16.1.15-1 below summarizes the major Utah laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 16.1.15-1: Relevant Utah Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Utah Administrative Code: Title R315	UDEQ	Regulates treatment, storage, and disposal of hazardous waste, as well as environmental response and remediation to mitigate impacts to public health and safety.
Utah Code: Title 34A, Chapter 6	UOSH	Establishes the Utah Occupational Safety and Health Act to protect worker health and safety, including requiring the collection and management of statistics and implementing educational and training programs.
Utah Administrative Code: Title R614	UOSH	Identifies the UOSH as the authority for administering OSHA requirements and establishes worker safety standards for various industries, including recordkeeping.
Utah Code: Title 53, Chapter 2a, Part 7	UDEQ and Utah Department of Public Safety (UTDPS)	Establishes the Hazardous Materials Emergency Act and identifies the UDEQ and UTDPS as authorities for implementing and managing the Emergency Planning and Community Right To Know Act (EPCRA) of 1986 to protect public health and safety.
Utah Code: Title 26	UTDOH	Establishes the Utah Health Code to protect public safety and health, including cooperating with the UDEQ to assess and manage human health risks from the environment.
Utah Code: Title 40	Utah Labor Commission, Office of Coal Mine Safety	Establishes the Utah Mined Land Reclamation Act and including health and safety inspections and reporting requirements.

16.1.15.3. 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 waterbodies, and on communication towers. Tasks may also be performed at dangerous heights, while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring. 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 – In rare cases, FirstNet deployment, operation, and maintenance activities may involve work in confined spaces. Installation and maintenance of underground utilities in urban areas or utility manholes[134] are examples of when confined space work could occur. 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 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

[134] 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.

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 16.1.13, Noise) (OSHA, 2002). Fugitive noise may emanate beyond the telecommunication work site and impact the public living in the vicinity, observing the work, or transiting through the area (OSHA, 2016b).

Hazardous materials and hazardous waste – Work at telecommunication sites may require the storage and use of hazardous materials such as fuel sources for backup power generators, and compressed gases used for welding and metal cutting (new towers only). In some cases, telecommunication sites require treatments, such as pesticide application. Secondary hazardous materials, like exhaust fumes, may be a greater health risk than the primary hazardous material (i.e., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. While it is unlikely that any FirstNet activities would involve the generation or storage of hazardous waste, older existing telecommunication structures and sites could have hazardous materials present, such as lead-based 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 (OSHA, 2016b).

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

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

Telecommunication Worker Occupational Health and Safety

The U.S. Department of Labor, Bureau of Labor Statistics (BLS) uses established industry and occupational codes to classify telecommunications workers. For industry classifications, BLS uses the North American Industry Classification System (NAICS) codes, which identify the telecommunications industry (NAICS code 517XX) as being within the information industry (NAICS code 51). For occupational classifications, BLS uses the Standard Occupational Classification (SOC) system to identify workers as belonging to one of 840 occupations.

Telecommunications occupations are identified as either telecommunication equipment installers and repairers, except line installers (SOC code 49-2022), or telecommunication line installers and repairers (SOC code 49-9052). Both occupations are reported under the installation, maintenance and repair occupations (SOC code 49-0000).

As of May 2014, there were 1,950 telecommunication equipment installers and repairers, and 1,040 telecommunication line installers and repairers (Figure 16.1.15-1) working in Utah (Bureau of Labor Statistics, 2015f). In 2013, the most recent year data are available, Utah had 2.2 cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (Bureau of Labor Statistics, 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 (Bureau of Labor Statistics, 2013b).

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; three due to transportation incidents; and seven due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (Bureau of Labor Statistics, 2013c). This represents 45 percent of the broader information industry fatalities (40 total), and less than one percent of occupational fatalities (4,585 total). Utah has not had any fatalities in the telecommunications industry or telecommunications occupations since 2003, when data are first available (Bureau of Labor Statistics, 2015b). By comparison, in the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 39 fatalities in Utah between 2003 and 2014, including four fatalities reported in preliminary data for 2014, with the highest being six fatalities in 2009 (Bureau of Labor Statistics, 2015e).

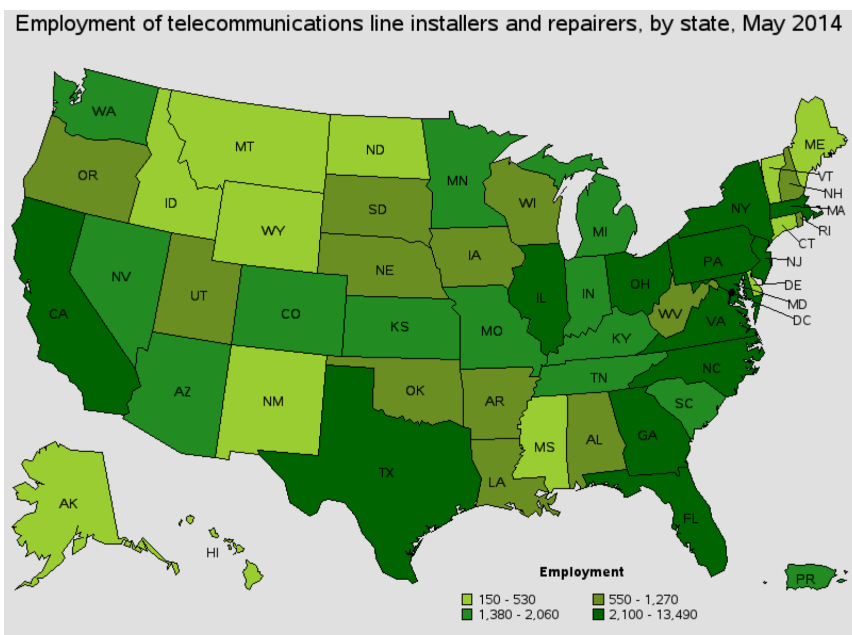

Figure 16.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (Bureau of Labor Statistics, 2015c)

Public Health and Safety

The general public is unlikely to encounter occupational hazards at telecommunication sites, due to limited access. Utah collects injury surveillance and fatality data among the general public through the UTDOH Public Health Indicator Based Information System (IBIS) (Utah Department of Health, 2015b). The same data are reported with more specificity at the federal level through the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (WONDER). While the WONDER database cannot be searched for cases specific to telecommunication sites, many available injury categories are consistent with risks present at telecommunication sites. For example, in Utah, between 1999 and 2013, there were 58 fatalities due to a fall from, out of, or through a building or structure; 0 fatalities due to exposure to electric transmission lines; and 16 fatalities due to being caught, crushed, jammed or pinched in or between objects (Centers for Disease Control and Prevention, 2015a). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to the health and safety hazards.

16.1.15.4. Environmental Setting: Contaminated Properties at or near Telecommunication Sites

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

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[135] 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.

The UDEQ Division of Environmental Response and Remediation assists the USEPA's Superfund program by performing activities in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (UDEQ, 2015n). As of October 2015, Utah had 22 RCRA Corrective Action sites,[136] 132 brownfield sites, and 24 proposed or final Superfund/NPL sites (USEPA, 2015n). Based on a October 2015 search of

[135] 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, 2011a).

[136] Data gathered using USEPA's Cleanups in My Community (CIMC) search on October 15, 2015, for all sites in Utah, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (USEPA, 2013c).

USEPA Cleanups in My Community (CIMC) database, there are two Superfund sites (Jacobs Smelter and Hill Air Force Base) in Utah where contamination has been detected at an unsafe level, or a reasonable human exposure risk still exists (USEPA, 2015j).

Brownfield sites in Utah may enroll in a variety of programs managed by UDEQ's Division of Environmental Response and Remediation, including the Brownfields Program, Petroleum Brownfields Program, and the Voluntary Cleanup Program, designed to remediate and redevelop contaminated properties (UDEQ, 2015n). One example of a brownfield site is the 650-acre Gateway Development in Salt Lake City, UT. This former industrial site had been used for railroad manufacturing and maintenance, salvage yards, and other industrial purposes dating back to the 19th century. Approximately 50 percent of the area was contaminated, contributing to abandonment of the downtown district (USEPA, 2003). Remediation activities included soil excavation and topsoil removal to prepare for underground parking structures (Envision Utah, 2006). The site now includes new residential units, retail, restaurants, and a transportation hub (USEPA, 2003).

Uranium mining and milling activity in Utah pose additional health and safety hazards to the general public and potentially to occupational workers installing infrastructure on contaminated land. Uranium extraction produces mill tailings, a radioactive ore residue containing heavy metals and radium that presents radiation exposure through airborne decay products or in water supplies. These tailings were occasionally used as aggregate or other residential building materials, presenting additional risk of lung cancer and kidney failure to inhabitants. Between 1944 and 1986, the federal government and the commercial industry extracted nearly four million tons of uranium ore within the Navajo Nation across New Mexico, Utah, and Arizona. Across New Mexico today, there are more than 500 abandoned uranium mines on Navajo lands. USEPA, the Bureau of Indian Affairs, and other associated agencies have developed a Five-Year Plan to address uranium contamination in the Navajo Nation (USDOE et. al., 2014). In 2006, the USEPA compiled over 4,000 federal, state, and Tribal uranium mine records to identify potential problem areas. However, the location of many uranium sites remains unknown since uranium was not always the primary mined material, and abandoned mines may not have been assessed for potential radioactive hazards such as tailings (USEPA, 2006).

In Utah, the Division of Radiation Control regulates uranium mills and associated radioactive material disposal and includes programs as the Uranium Mills and Disposal Facilities Program and Moab Millsite Stakeholder Group (UDEQ, 2014b). Although assessment, cleanup, and health studies are ongoing in Utah, actions already taken include prioritizing mine sites for cleanup, demolishing contaminated structures, and providing financial compensation to impacted residents (USDOE et. al., 2014). One example of a Utah uranium mill is the Moab uranium mill tailings site, a 480-acre "former uranium-ore processing facility" located in Grand County. The mill closed in 1984 after 28 years of operation and left approximately 16 million tons of tailings and contaminated soil (USDOE, 2013). USDOE took responsibility of the site after the Uranium Mill Tailings Radiation Control Act was passed in 1978 to address "potential health hazards of long-term exposure to radiation from uranium mill tailings" (USDOE, 2005). Remedial action to relocate contaminated waste and soil to a permanent site is ongoing at the site (USDOE, 2005).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the overall chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). As of October 2015, Utah had 186 TRI reporting facilities. The identification of a TRI facility does not necessarily indicate that the facility is actively releasing to the environment; the majority of TRI reports involve permitted disposal facilities. According to the USEPA, in 2013, the most recent data available, Utah released 525,433,866 pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from metal mining industries. This accounted for 12.8 percent of nationwide TRI releases, ranking Utah two of 56 U.S. states and territories based on total releases per square mile (USEPA, 2014a).

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 March 2016, Utah had 43 major NPDES permitted facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015p).

The National Institute of Health (NIH), U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (NIH, 2015a). Figure 16.1.15-2 provides an overview of potentially hazardous sites in Utah.

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 waterbodies. Indoor air quality may also be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. As of October 2015, there is one USEPA-regulated telecommunications site in Utah (Qwest Communications), in East St. George (USEPA, 2015t). This site is regulated for hazardous waste under RCRA.

According to BLS data, Utah had four occupational fatalities each in 2011, 2013, and 2014 within the installation, maintenance, and repair occupations from exposure to "harmful substances or environments," although these were not specific to telecommunications (Bureau of Labor Statistics, 2013d). By comparison, the Bureau of Labor Statistics reported three fatalities in 2011 and three fatalities in 2014[137] nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments (Bureau of Labor Statistics, 2015d). In 2014, BLS also reported four fatalities[138] within the telecommunications line installers and repairers occupation (SOC code 49-9052), and no fatalities within the telecommunications equipment installers and repairers occupation (SOC code 49-2022) due to exposure to harmful substances or environments (Bureau of Labor Statistics, 2014).

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 source. 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.

[137] 2014 fatality data is still preliminary according to the Census of Fatal Occupational Injuries.

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

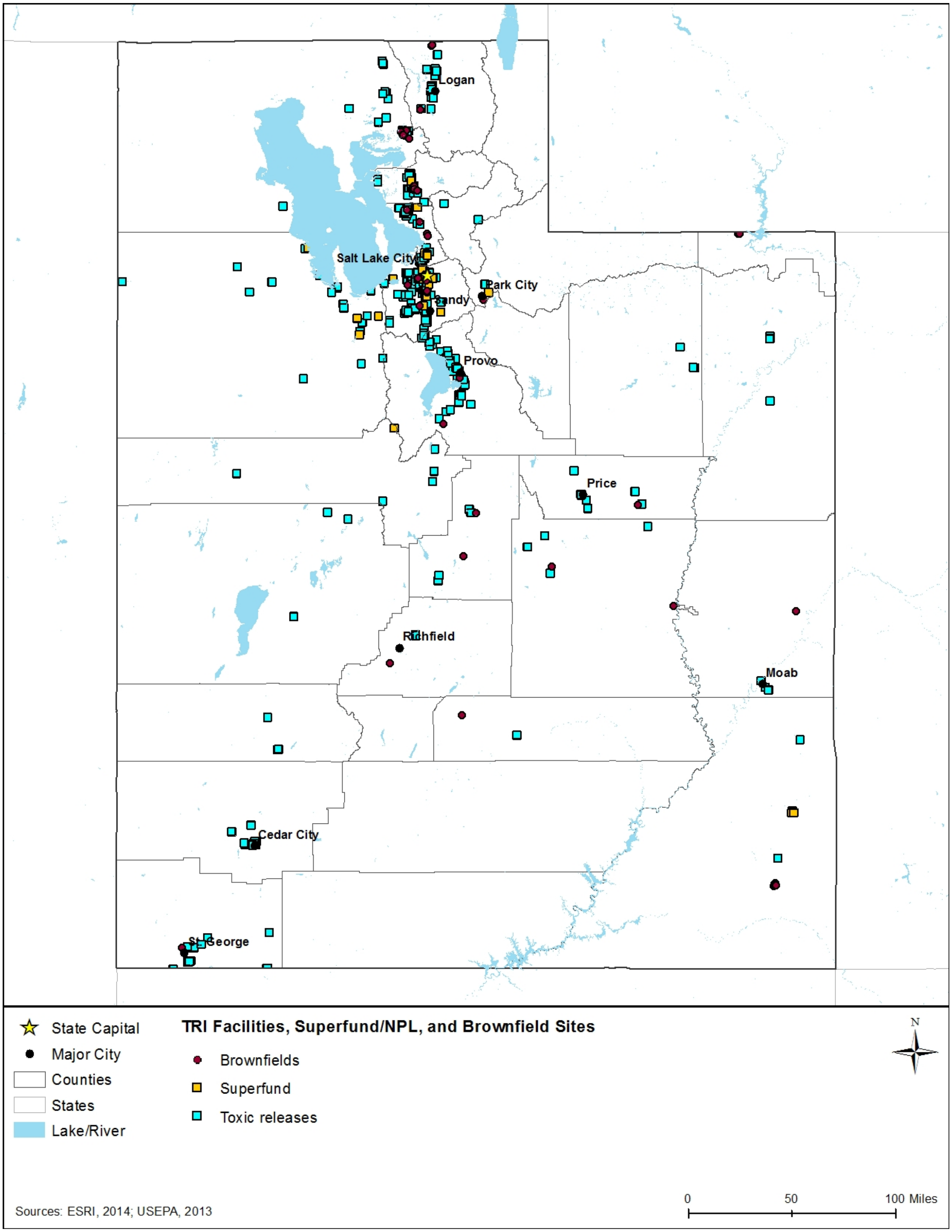

Figure 16.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Utah (2013)

Spotlight on Utah Superfund Sites: Eureka Mills

Eureka Mills is a 450-acre site within the historic Tintic Mining District in Juab County, UT, used for mining and milling operations from late 1800s to 1958 (USEPA, 2011b). The site includes the Gemini Mine (Figure 16.1.15-3), where contamination from large waste rock piles and other related activities, including using "mine waste for urban construction," spread to adjacent residences and businesses.

The USEPA conducted a Removal Evaluation study in 2000 after UTDEQ discovered lead concentrations of 47,800 parts per million (ppm) in residential soils, significantly higher than USEPA's 400 ppm level of concern for residents (USEPA, 2002a). A separate 2001 study conducted by the Agency for Toxic Substance and Disease Registry (ATSDR) found that "children living in Eureka, UT, are 10 times more likely to have elevated blood lead levels than other Utah children. Prevalence of elevated blood lead levels was high for both young children and teenagers." (Agency for Toxic Substance and Disease Registry, 2005).

Between 2001 and 2010, cleanup activities were conducted at more than 700 residential properties, including excavation and capping 18 inches of topsoil. Periodic monitoring of lead in area children, information programs, and indoor lead exposure evaluations were also implemented. (USEPA, 2011c) USEPA's most recent 5-year review concluded that short-term human and ecological exposures are under control (USEPA, 2015f).

Figure 16.1.15-3: Before and After Superfund Cleanup at Gemini Mine, Eureka, UT

Source: (Utah Department of Health, Bureau of Epidemiology, 2014)

The UTDOH, Bureau of Epidemiology provides publicly available health assessments and consultations that identify and assess human exposure risks at contaminated sites through a partnership with the federal Agency for Toxic Substances and Disease Registry (ASTDR), known as ASTDR's Partnership to Promote Localized Efforts to Reduce Environmental Exposures (APPLETREE) (Utah Department of Health, 2011b). At the federal level, the Centers for Disease Control and Prevention, National Environmental Public Health Tracking Network, provides health, exposure, and hazard information, including known chemical contaminants, chronic diseases, and conditions based on geography. In 2011, the most recent year data are available, Utah reported a rate of four injuries and fatalities due to reported acute toxic substance release incidents per 100,000 population (Centers for Disease Control and Prevention, 2015b). According to the UTDOH IBIS, between 2000 and 2010, 1,097 injuries or fatalities have occurred in Utah due to acute uncontrolled, illegal, or threatened releases of hazardous substances (Utah Department of Health, 2015c)

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

Another health and safety hazard in Utah includes surface and subterranean mines, including uranium mines. In 2015, the Utah mining industry ranked 8th for non-fuel minerals (primarily molybdenum concentrates, copper, magnesium metal, potash, and salt), generating a value of $2.93B (USGS, 2016a). In 2013, the most recent data available, Utah had 17 coalmining operations (14 underground and 3 surface) (U.S. Energy Information Administration, 2013). Health and safety hazards at active mines and AMLs 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, 2015a).

In Utah, the Department of Natural Resources' Division of Oil, Gas, and Mining administers the Abandoned Mine Reclamation Program, and is responsible for "proper mine operation and reclamation of affected lands" to protect public safety (Utah Department of Natural Resources, Division of Oil, Gas, and Mining, 2014). As of 2015, there were 10,697 known abandoned mines in Utah, including uranium mines (BLM, 2015b). However, according to the BLM, no complete inventory of BLM lands has been conducted in Utah (BLM, 2015c). Figure 16.1.15-4 shows the distribution of High Priority (Priority 1, 2 and adjacent Priority 3) AMLs in Utah, 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 October 2015, Utah had 226 Priority 1 and 2 AMLs, with 66 unfunded problem areas (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2014).

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 mines 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, mine 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, Office of Surface Mining Reclamation and Enforcement, 2015). One example is the Wilberg Mine, located near Orangeville, Utah, disaster of 1984 in Emery County, which occurred when a faulty air compressor caught on fire in a compressor station that was not fire-proofed. The smoke and toxic gases blocked most of the escapeways, killing 27 people (GAO, 1987). Utah promotes a "Stay Out, Stay Alive" program, to educate the public of the dangers of abandoned mines (Utah Department of Community & Culture, Mining Heritage Alliance, 2014).

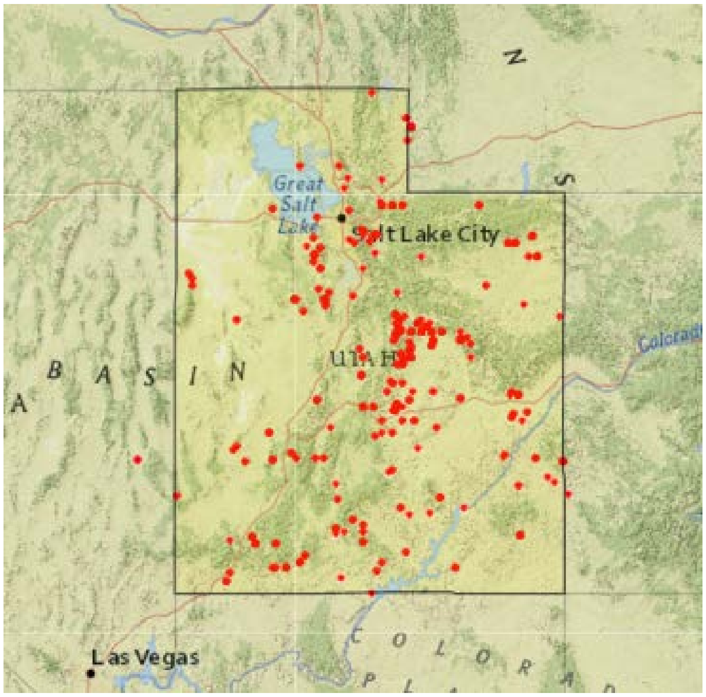

Figure 16.1.15-4: High Priority Abandoned Mine Lands in Utah (2015)

Source: (Office of Surface Mining Reclamation and Enforcement, 2015)

16.1.15.6. Environmental Setting: Natural and Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the public. Telecommunications, including public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Hazardous chemicals and sanitary wastes often contaminate floodwaters, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003). In Utah, natural or manmade disasters could result in an uncontrolled release of radioactive material from abandoned uranium mines and mills, increasing potential risk to health and safety. Other natural hazards common to Utah include avalanches and lightning strikes. Between 1959 and 2014, Utah ranked 11th in the United States for population-weighted lightning fatalities at 0.59 per million people (11 total) (NOAA, 2015d). Between 2004 and 2014, avalanches caused another 40 fatalities (Utah Avalanche Center, 2014).

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

Currently, the Utah Labor Commission 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 88 NRC-reported incidents for Utah in 2015 with known causes, two were attributed to natural disaster (flooding or other natural phenomenon), while 86 incidents were attributed to manmade disasters (e.g., derailment, dumping, equipment failure, operator error, over pressuring, transport accident, or trespasser) or other indeterminate causes (U.S. Coast Guard, 2015). For example, on February 6, 2015, an excavator caught fire due to equipment failure outside of Ephraim, UT, spilling hazardous materials onto the surrounding soil. The County Sherriff and local fire department responded to the scene. (U.S. Coast Guard, 2015) Such incidents present unique, hazardous challenges to telecommunication workers responding during natural or 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, Utah had five weather-related fatalities (two due to flooding and three due to unknown causes) and five injuries. By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year (NWS, 2015b).

Spotlight on Utah Natural Disaster Sites: 1999 Salt Lake City Tornado

On August 11, 1999, the most destructive tornado in Utah's history struck downtown Salt Lake City, UT (National Weather Service Forecast Office, Salt Lake City, UT, 2010). Although the EF-2 tornado only lasted ten minutes, it traveled directly through the downtown business district mid-day with wind speeds between 113–157 miles per hour (NOAA, 2010), severely damaging a hospital, businesses, residences, and even "knocking down scaffolding and shearing off a crane" at a construction site (National Weather Service Forecast Office, Salt Lake City, UT, 2010) (Utah Department of Administrative Services, 1999). The tornado also destroyed public infrastructure and power lines causing widespread outages (Figure 16.1.15-5), damaged 300 buildings and homes, and uprooted or damaged 800 trees. The combination of downed lines and debris created significant hazards for the public and recovery workers (Utah Department of Administrative Services, 1999). Damages from the storm totaled $170M, 1 fatality, and 80 injuries (National Weather Service Forecast Office, Salt Lake City, UT, 2010).

Figure 16.1.15-5: Power Substation Exploding, August 11, 1999, after being Struck by Tornado Salt Lake City, UT

16.2. ENVIRONMENTAL CONSEQUENCES

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

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

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

16.2.1. Infrastructure

16.2.1.1. Introduction

This section describes potential impacts to infrastructure in Utah 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

16.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 16.2.1-1. As described in Section 16.2, 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 16.2.1-1: 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

<table>
<tr><th rowspan="2">Type of Effect</th><th rowspan="2">Effect Characteristics</th><th colspan="4">Impact Level</th></tr>
<tr><th>Potentially Significant</th><th>Less than Significant with BMPs and Mitigation Measures Incorporated</th><th>Less than Significant</th><th>No Impact</th></tr>
<tr><td rowspan="3">Effects to utilities, including electric power transmission facilities and water and sewer facilities</td><td>Magnitude or Intensity</td><td>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.</td><td rowspan="3">Effect that is potentially significant, but with mitigation is less than significant.</td><td>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.</td><td>There would be no perceptible impacts to delivery of other utilities and no service disruptions.</td></tr>
<tr><td>Geographic Extent</td><td>Local/City, County/Region, or State/Territory.</td><td>Local/City, County/Region, or State/Territory.</td><td>Local/City, County/Region, or State/Territory.</td></tr>
<tr><td>Duration or Frequency</td><td>Effects to other utilities would be seen throughout the entire construction phase.</td><td>Effects to other utilities would be of short duration (minutes to hours) and would occur sporadically during the entire construction phase.</td><td>NA</td></tr>
</table>

NA = Not Applicable

16.2.1.3. Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would mostly 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 would be necessary with the relevant transportation authority (i.e., Utah Department of Roads, airport authorities, and railway companies) to ensure proper coordination during deployment.

Based on the impact significance criteria presented in Table 16.2.1-1, such impacts would be less than significant due to the temporary nature of the deployment activities. 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. With 24,458 first responder or related personnel, 531 fire stations and registered fire departments, and 255 sheriff or local police department agencies in Utah, the capacity to impact first responder services must be taken into consideration (Table 16.1.1-5 and Table 16.1.1-6) (National Fire Department Census, 2015) (Reaves, 2011). 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 16.2.1-1, 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 16.2.1-1, any potential impacts would be less than significant during deployment. As described above, during deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to complement such practices and SOPs in a positive manner; therefore, only beneficial or complementary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience 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 are anticipated to be less than significant given the short-term nature of the deployment activities.

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

The Utah Communications Authority (UCA) assumed control of the Utah Communications Agency Network operating at VHF and 800 MHz which is the statewide network servicing public safety users (RadioReference.com, 2015a). There are over 500 commercial towers in Utah (FCC, 2015d). Commercial telecommunication systems, communications, or level of service would experience no impacts, as such commercial assets would likely 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.[139] 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 Utah Public Service Commission (PSC) regulates private investor-owned public utilities such as electric, water, and sewage companies. The activities proposed by FirstNet would have less than significant impacts on utilities, including electric power transmission facilities, and water and sewer facilities, due to the limited extent and temporary nature of the deployment. Depending on the specific project contemplated, installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on a temporary or permanent basis. Also, depending on the specific project contemplated, the draw or use of power from the transmission facilities may need to be examined; however, it is not anticipated that such

[139] 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.

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.

16.2.1.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to infrastructure resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would have no impacts to infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any impacts to infrastructure resources, given that construction activities would occur on existing structures, would not be expected to interfere with existing equipment, and transportation capacity and safety, and access to emergency services would not be impacted.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts

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

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs)[140], 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.
  - 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.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Although lighting up of dark fiber would have no impacts to infrastructure resources as mentioned above, installation of new associated huts or equipment, if required, could impact infrastructure resources, depending on the exact siting of such installation activities.
  - 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. However, impacts to infrastructure resources could potentially occur as result of the construction of landings and/or facilities on shores or the banks of water bodies that accept submarine cable, depending on the exact site location and proximity to existing infrastructure.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment such as small boxes or huts, or access roads, could potentially impact infrastructure. Impacts could include disruption of service in transportation corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation

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

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

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. 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, and system redundancy. These impacts are expected to be less than significant due to the limited extent and temporary 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 infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the above mentioned 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 result as explained above, although these potential impacts would be expected to be minor and temporary, and therefore less than significant. 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.

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 improve high-speed data capabilities, location information, images, and eventually streaming video, which would enhance 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.

16.2.1.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred

Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to infrastructure if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. Impacts would likely be less than significant due to the limited extent and temporary nature of the deployment. 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 avoid any negative impacts to such resources. 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. 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. As noted above, these impacts are expected to be less than significant due to the limited extent and temporary nature of the deployment.

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 of established access roads or utility ROWs, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts could occur to transportation systems or utility services, due to the limited extent and temporary 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.

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

16.2.2. Soils

16.2.2.1. Introduction

This section describes potential impacts to soil resources in Utah 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.

16.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 16.2.2-1. As described in Section 16.1.2, 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 soils addressed in this section are presented as a range of possible impacts.

Table 16.2.2-1: 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

16.2.2.3. 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 Utah and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment could impair water and habitat quality, and potentially affect aquatic plants and animals (USDA NRCS, 2000). Areas exist in Utah that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Aquents, Aquepts, Aquolls, Argids, Calcids, Cambids, Cryalfs, Cryepts, Cryolls, Durids, Fluvents, Gypsids, Orthents, Psamments, Rendolls, Salids, Saprists, Torrerts, Udalfs, Udolls, Ustalfs, Ustepts, Ustolls, Xeralfs, Xerands, Xerepts, and Xerolls suborders, which are found throughout the state (see Section 16.1.2.6, Soil Erosion and Figure 16.1.2-2).

Based on the impact significance criteria presented in Table 16.2.2-1, building of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades.

To the extent practicable, FirstNet would minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. 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.

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 the impact significance criteria presented in Table 16.2.2-1, and due to the relatively small scale (less than one acre) of most FirstNet project sites, impacts would be less than significant. 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.

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could result from 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, although BMPs and mitigation measures may help to reduce impacts.

Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (Section 16.1.2.4, Soil Suborders). Soils with the highest potential for compaction and rutting in Utah include those in the Aquents, Aquepts, Aquolls, Salids, and Saprists suborders, which are found throughout Utah (Figure 16.1.2-2). These soils account for 9.71 percent of Utah's total soil volume. 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 16.2.2-1, 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. 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.

16.2.2.4. 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, 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 POPs that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel, or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in 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 the construction activity.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of optical transmission equipment or centralized transmission equipment, including associated new utility poles, hand holes, pulling vault, junction box, hut, and POP structure installation, would require ground disturbance that could potentially impact soil

resources. Potential impacts to soils resulting from soil erosion, topsoil mixing, soil compaction, and rutting are anticipated to be small-scale and short-term.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant due to the limited extent and temporary 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 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 above mentioned 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. These impacts are expected to be less than significant due to the limited extent and temporary 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.

16.2.2.5. 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. Impacts would likely be less than significant due to the limited extent and temporary nature of the deployment. 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. It is anticipated that impacts would 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.

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 due to the limited extent and temporary 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.

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 16.1.2, Soils.

16.2.3. Geology

16.2.3.1. Introduction

This section describes potential impacts to Utah 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.

16.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 16.2.3-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to geology addressed in this section are presented as a range of possible impacts.

Table 16.2.3-1: Impact Significance Rating Criteria for Geology

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

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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory.		Areas with known paleontological resources occur within the state/territory, but may be avoidable.	Areas with known paleontological resources do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Surface Geology, Bedrock, Topography, Physiography, and Geomorphology	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes.	Effect that is potentially significant, but with mitigation is less than significant.	Minor degradation or alteration of surface geology, bedrock, topography that do not result in measurable changes in physiographic characteristics or geomorphological processes.	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes.
	Geographic Extent	State/territory.		State/territory.	NA
	Duration or Frequency	Permanent or long-term changes to characteristics and processes.		Temporary degradation or alteration of resources that is limited to the construction and deployment phase.	NA

NA = Not Applicable

16.2.3.3. 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

As discussed in Section 16.1.3.8, areas of greatest seismicity in Utah are focused in the central portion of the state running from north to south (Figure 16.1.3-4). Based on the impact significance criteria presented in Table 16.2.3-1, 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. Equipment that is exposed to earthquake activity is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss. Given the potential for minor earthquakes in or near parts of Utah, some amount of infrastructure could be subject to earthquake hazards. 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.

Volcanic Activity

Active volcanoes do not occur in Utah and therefore do not present a hazard to the state (USGS, 2015g).

Landslides

As discussed in Section 16.1.3.8, landslides are most common in portions of Utah within the Southern Rocky Mountains and Colorado Plateau Provinces. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. Based on the impact significance criteria presented in Table 16.2.3-1, potential impacts to landslides potential from deployment or operation of the Proposed Action would have less than significant impacts due to the limited extent and temporary nature of the deployment; 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. However, some amount of infrastructure could be subject to landslide hazards. 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.

Land Subsidence

As discussed in Section 16.1.3.8, land subsidence due to groundwater extraction and subsequent aquifer compression has been documented throughout the southwestern part of the state. Based on the impact significance criteria presented in Table 16.2.3-1, potential impacts to soil subsidence from deployment of operation of the Proposed Action would have less than significant impacts due to the limited extent and temporary nature of the deployment; however, subsidence impacts to the Proposed Action could be potentially significant to the Proposed Action if FirstNet's deployment locations were within areas at high risk to karst topography or mining areas. Equipment that is exposed to land subsidence, such as sinkholes created by karst topography or mine collapse, is subject to misalignment, alteration, or, in extreme cases, destruction. All of these activities could result in connectivity loss. To the extent practicable, FirstNet would avoid deployment in known or abandoned mined areas. 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.

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 16.2.3-1, impacts to mineral and fossil fuel resources is unlikely as the Proposed Action could only be potentially significant if the FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. The Proposed Action is likely to have less than significant impacts due to the expected small scale of likely FirstNet projects. To the extent practicable, FirstNet would avoid construction in areas where these resources exist.

Paleontological Resource Impacts

Equipment installation and construction activities that require ground disturbance could damage existing paleontological resources, which are both fragile and irreplaceable. Based on the impact significance criteria presented in Table 16.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. Potential impacts to fossil resources should be considered on a site-by-site basis. 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.

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 16.2.3-1, 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 less than significant, because they are not likely to require removal of significant volumes of terrain. 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 operation activities.

Deployment Impacts

Implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities have the potential to be impacted by geologic hazards, some activities could result in potential impacts to geology, and other activities would have no impacts. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. In most cases, there would be no impacts to geologic resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact geologic resources, it is anticipated that this activity would have no impact on geologic resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral and fuel resources and paleontological resources. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to earthquakes, landslides, 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 earthquakes, landslides, 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 earthquakes, landslides, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water is not expected to impact geologic resources including marine paleontological resources. . However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to earthquakes, landslides, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or disturbance of geologic resources. Where equipment is installed in locations that are susceptible to earthquakes, landslides, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an

existing tower, which would not result in ground disturbance. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to earthquakes, landslides, and other geologic hazards, it is possible that equipment could be affected by that hazard.

- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.

- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. However, where equipment is permanently installed in locations that are susceptible to earthquakes, landslides, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact to the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geology associated with deployment could include minimal removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet projects are likely to be small scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small scale. Therefore, these impacts are expected to be less than significant due to the limited extent and temporary 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 infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above mentioned deployment impacts. It is anticipated that there would be no impacts to geology associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections.

The operation of the Preferred Alternative could be affected by geologic hazards including seismic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant due to the limited extent and temporary 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.

16.2.3.4. 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 limited extent and temporary 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 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 due to the limited extent and temporary 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.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to geologic resources (or from geologic hazards) as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 16.2.3, Geology.

16.2.4. Water Resources

16.2.4.1. Introduction

This section describes potential impacts to water resources in Utah 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.

16.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 16.2.4-1. As described in Section 16.2, 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 16.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, SDWA.	Effect that is potentially significant, but with mitigation is less than significant.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than six months.	NA
Floodplain degradation*	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is potentially significant, but with mitigation is less than significant.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than one season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, lasting no more than six months.	NA
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge.	Effect that is potentially significant, but with mitigation is less than significant.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody (stream height).
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts.	Activities do not impact groundwater or aquifers.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA

*Since public safety infrastructure is considered a critical facility, project activities should avoid the 500-year floodplain wherever practicable, per the Executive Orders on Floodplain Management (EO 11988 and EO 13690).
NA = Not Applicable

16.2.4.3. 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.

The surface waters in the state have been degraded to some extent. As shown in Table 16.1.4-2, various sources affect Utah's waterbodies, causing impairments. Approximately one-third of Utah's assessed rivers and streams and lakes, reservoirs, and ponds are impaired. Designated uses of the impaired rivers and streams include agricultural, cold and warm water aquatic life, domestic water supply, non-game fish and other aquatic life, secondary recreation, and wildlife habitat. Designated uses of the impaired lakes, reservoirs, and ponds include agricultural and cold and warm water aquatic life (USEPA, 2015b). Groundwater quality within the state is generally good for most domestic uses (Moody, Carr, Chase, & Paulson, 1986).

Deployment activities could contribute pollutants in a number of ways but the primary manner is increased sediment in surface waters. Vegetation removal on site exposes soils to rain and wind that 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 one acre of soil, a Utah Pollutant Discharge Elimination System (UPDES) Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs could help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs could reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA, SDWA), and local regulations, cause a threat to the human environment, biodiversity, or ecological integrity through water degradation, or cause a sediment water quality violation from local construction, or otherwise substantially degrade water quality.

Therefore, based on the impact significance criteria presented in Table 16.2.4-1, water quality impacts would likely be less than significant due to the limited extent and temporary nature of the deployment, and could be further reduced if BMPs and mitigation measures were to be incorporated where practicable and feasible.

During implementation of the Proposed Action and Alternatives, there is the potential to encounter shallow groundwater due to clearing and grading activities, shallow excavation, or relocation of utility lines. This is unlikely, as trenching is not expected to exceed a 48-inch depth. However, groundwater contamination may exist in areas directly within or near the project area. If trenching[141] 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 Utah dewatering requirements. Any contaminated groundwater extracted during dewatering activities or as required by a dewatering permit would be treated prior to discharge or disposed of at a wastewater treatment facility.

There is little potential for groundwater contamination within a watershed or multiple watersheds. Thus, it is unlikely that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer, and based on the impact significance criteria presented in Table 16.2.4-1, there would likely be less than significant impacts on groundwater quality within most of the state due to the limited extent and temporary nature of the deployment. 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 16.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet's deployment, on the watershed or subwatershed level would use minimal fill, would not substantially increase

[141] Telecommunications activities involve laying conduit, with minimal trenching. Trenching activities would likely be at a minimal depth (less than 36 inches) and width (6 to 12 inches).

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,[142] or occur only during an emergency.

Examples of activities that would have less than significant impacts include:

- Construction of any structure in the 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.
- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

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.

Drainage Pattern Alteration

Flooding and erosion from land disturbance could change drainage patterns. Stormwater runoff causes erosion while construction activities and land clearing could change drainage patterns. Clearing or grading activities or the creation of walls or berms could alter water flow in an area or cause changes to drainage patterns. Drainage could be directed to stormwater drains, storage, and retention areas designed to slow water and allow sediments to settle out. Improperly handled drainage could cause increased erosion, changes in stormwater runoff, flooding, and damage to water quality. Existing drainage patterns could be modified by channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 16.2.4-1, 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 due to the limited extent and temporary nature of the deployment.

Examples of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited stormwater runoff.
- Where stormwater is contained on site and does not flow to or impact surface waterbodies offsite on other properties.
- Activities designed so that the amount of storm water generated before construction is the same as afterwards.
- Activities designed using low impact development (LID) techniques for storm water.

[142] 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, 2014i)

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term, impacts to drainage patterns would be less than significant. BMPs, mitigation measures, and avoidance could be implemented to further reduce any potentially significant impacts.

Flow Alteration

Flow alteration refers to the modification of flow characteristics, relative to natural conditions. Human activities may change the amount of water reaching a stream, divert flow through artificial channels, or alter the shape and location of streams. Surface water and groundwater withdrawals 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 16.2.4-1. 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 basis (no more than six months) are likely to have less than significant impacts on flow alteration, on a watershed or subwatershed level, due to the limited extent and temporary nature of the deployment. Examples of projects likely to have less than significant impacts include:

- Construction of any structure in a 100-year or 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns off site or into surface waterbodies that have not received that volume of stormwater before.
- Minor clearing or grading activities.

Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be less than significant impacts to flow alteration. BMPs, mitigation measures, and avoidance could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 16.1.4.7, approximately 60 percent of Utah residents use groundwater for their drinking water. Generally, the water quality of Utah's aquifers is suitable for drinking and daily water needs (Moody, Carr, Chase, & Paulson, 1986). 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 due to implementation of BMPs and mitigation measures for fuel storage. 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.

Activities that may cause changes is groundwater or aquifer characteristics include:

- Excavation, mining, or dredging during or after construction.
- Any liquid waste, including but not limited to wastewater, generation.
- Storage of petroleum or chemical products.
- Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).
- Deployment activities should be less than significant since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. The siting of deployment activities should be considered to avoid areas that would extract groundwater from potable groundwater sources in the area.

16.2.4.4. 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 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 water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit

points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to water resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to water resources because there would be no ground disturbance.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water. Implementing BMPs and mitigation measures could reduce impact intensity.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to 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 and potential groundwater impacts from trenching. If a new roadway were built, any additional impervious surface could impact water resources by increasing 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 could cause impacts to water quality from increased suspended solids.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to water resources

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security 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 are needed, 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 limited extent and temporary nature of the deployment. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts. These impacts would likely be less than significant due to the limited extent and temporary 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, and are expected to have no impacts. 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 unlikely due to implementation of BMPs and mitigation measures. 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.

16.2.4.5. 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 on paved surfaces if there is any runoff into the surface water. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect less than significant impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Potential impacts depend on installation technique, location, and the land area affected. All impacts would be less than significant due to the limited extent and temporary 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 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 above mentioned 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. Site maintenance, including mowing or herbicides, is anticipated to 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. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no 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 Section16.1.4, Water Resources.

16.2.5. Wetlands

16.2.5.1. Introduction

This section describes potential impacts to wetlands in Utah 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

16.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 16.2.5-1. As described in Section 16.2, 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 16.2.5-1: 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[1] or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 404 of the CWA.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No direct loss of wetlands.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
degradation (spills or sedimentation)	Duration or Frequency	Long-term or permanent alteration that is not restored within two 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, T/E species habitat, biodiversity, recreational/social value.

16.2.5.3. 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 small amount of land disturbance associated with likely proposed individual sites (generally less than an acre). 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 as defined through consultation with the appropriate resource agency. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

As described above in Section 16.1.5, Wetlands, and as shown in Figure 16.1.5-2 and Table 16.1.5-2, approximately one percent of the total landscape of Utah (about 592,000 acres) is wetlands. Based on the impact significance criteria presented in Table 16.2.5 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. In Iowa, as discussed in Section 16.1.5.4, Wetlands, there are no regulated high quality wetlands.

As discussed in Section 16.1.5.4, Wetlands of Special Concern, wetlands of special concern, or high quality wetlands, include bogs, fens, and peatlands. If any of the proposed deployment activities were to occur in these types of wetlands, potentially significant impacts could occur. Site-specific analysis would be required, in addition to BMPs and mitigation measures to avoid potentially significant impacts to wetlands. To assist with avoidance, all wetlands (as shown in Figure 16.1.5-2), are high quality wetlands. Additionally, all site-specific deployment locations will be subject to an environmental review, and potential impacts reduced below the level of significance by application of BMPs and mitigation measures. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Potential Other Direct Effects

Other direct effects consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, other direct effects would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through chemical, mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 16.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) may cause potentially significant impacts. In addition, introduction and establishment of invasive species to high quality wetlands within a watershed or multiple watersheds are potentially significant. Other direct effects to wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre), and the application of federal, state, and local wetlands regulations. Additionally, all site-specific deployment locations will be subject to an environmental review, and potential impacts reduced below the level of significance by application of BMPs and mitigation measures. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Examples of activities that could have other direct effects to wetlands in Utah 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:[143] Change in Function(s)[144] 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 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 application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. 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.

Examples of functions related to wetlands in Utah 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.

[143] 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

[144] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

- Groundwater Recharge: Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According to the significance criteria defined in Table 16.2.5-1, 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. In addition to protections under the state's regulations and national CWA, Utah considers certain wetland communities as areas of special value due to their global or regional scarcity, "unusual local importance," or habitat they support. These include bogs, fens, and peatlands in Utah. Since the majority of the approximate 592,000 acres of wetlands in Utah (USFWS, 2014a) are not considered high quality, and because deployment activities would be evaluated on a case by case basis, it is expected that deployment would have less than significant indirect impacts on wetlands in the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

16.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations could be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launches for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact on wetlands.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in across or near inland water bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
  - Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, or blimps, 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 limited extent of land disturbance during 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 infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above mentioned construction impacts. It is anticipated that there could be ongoing potential other direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are expected to be less than significant due to the implementation of BMPs and mitigation measures. 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.

16.2.5.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be less than significant due to the small scale of expected FirstNet deployment activities in any one location. 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 above mentioned 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 (e.g., land/vegetation clearing) to wetlands associated with routine inspections of the Deployable Technologies Alternative due to the limited extent of the deployment. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects to wetlands, depending on the proximity to, wetland type, and amount of herbicides used. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on wetlands, 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 wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 16.1.5, Wetlands.

16.2.6. Biological Resources

16.2.6.1. Introduction

This section describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Utah 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.

16.2.6.2. 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 16.2.6-1. As described in Section 16.2, 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 16.1.6.3, 16.1.6.4, and 16.1.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 16.2.6.5 for impact assessment methodology and significance criterial associated with threatened and endangered species in Utah.

Table 16.2.6-1: 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 Utah for at least one species. Anthropogenic[a] disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Habitat alteration in locations not designated as vital or critical for any period. Temporary losses to individual plants within cover types, or small habitat alterations take place in important habitat that is widely distributed and there are no cover type losses or cumulative effects from additional projects.	Sufficient habitat would remain functional to maintain viability of all species. No damage or loss of terrestrial, aquatic, or riparian habitat from project would occur.
	Geographic Extent	Regional effects observed within Utah 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 Utah 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	**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 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 Utah 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 Utah 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 Utah.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons.	NA

[a] Anthropogenic: "Made by people or resulting from human activities. Usually used in the context of emissions that are produced as a result of human activities" (USEPA, 2016d).

16.2.6.3. Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in Utah'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 16.2.6-1, significant direct injury or mortality impacts would only occur if potentially significant population-level or sub-population effects if they are observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale. The implementation of BMPs and mitigation measures and avoidance measures could help to minimize or altogether avoid potential impacts to plant population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical disturbance that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat. Areas near urban areas, such as Salt Lake City, Park City, and Provo, 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 recommended to minimize or avoid potential impacts.

Indirect Injury/Mortality

Indirect effects are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality 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 as an indirect effect, could lead to moisture stress and/or mortality of plant species that are adapted to specific hydrologic regimes. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment, though BMPs and mitigation measures could help to minimize or avoid the potential impacts.

Effects to Migration or Migratory Patterns

No effects to the long-term migration or migratory patterns for terrestrial vegetation (e.g., forest migration) are expected as a result of the Proposed Action, given the small scale of deployment activities.

Reproductive Effects

No reproductive effects to terrestrial vegetation are expected as a result of the Proposed Action given the small scale of deployment activities.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or, depending on its ability to spread rapidly and outcompete native species, invasive. The introduction of invasive species could have a dramatic effect on natural resources and biodiversity. The Utah Noxious Weed Control Act (Title 4, Chapter 17) stipulates that the commissioner be responsible for the establishment of the statewide noxious weed list and updates to that list, as necessary. In addition, the Act further stipulates that each county is responsible for implementing and enforcing noxious weed management. A total of 29 state-listed noxious weeds/complexes and plants are regulated in Utah (UCAF, 2010). None of these species occur on the Federal Noxious Weed List (USDA, 2014). These species/complexes are designated into one of the following three classes: Class A (Early Detection Rapid Response (EDRR); Class B (Control); and Class C (Containment) (Utah Commissioner of Agriculture and Food, 2010).

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. 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 terrestrial vegetation resources and others would not. In addition, the same type of Proposed Action infrastructure could result in a range impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology,[145] and the nature as well as the extent of the habitats affected.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although terrestrial vegetation could be impacted, it is anticipated that effects to vegetation would be minimal since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to terrestrial vegetation because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellite launches for other purposes, and the use of portable devices that use satellite technology would not impact terrestrial vegetation because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact biological resources, it is anticipated that this activity would have no impact on terrestrial vegetation.

[145] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to terrestrial vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact terrestrial vegetation. However, impacts to terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct or indirect injury to plants, vegetation loss, and invasive species effects.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads), microwave facilities, or access roads could result in impacts to terrestrial vegetation. Land/vegetation clearing,

excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to terrestrial vegetation. However, if new power units, replacement towers, structural hardening, and physical security measures require land clearing or excavation activities, impacts would be similar to new wireless construction.
- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct impacts to terrestrial vegetation if deployment occurs on vegetated areas, or the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects.
- Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact terrestrial vegetation if launching or recovery occurs on vegetated areas. Impacts would be similar to deployment of COWs, COLTs, and SOWs.

In general the abovementioned activities could potentially involve land/vegetation clearing; topsoil removal; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or cables; heavy equipment movement; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to terrestrial vegetation associated with deployment of this infrastructure, depending on their scale, could include direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the vegetation affected. These impacts are expected to be less than significant due to the limited extent and temporary 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, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection (e.g., application of herbicides or mowing), and periodic infrastructure replacement. Infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above-mentioned deployment impacts. Impacts to terrestrial vegetation would depend on the scale of the activities (e.g., amount of land disturbance), ecoregion, species' phenology, and the nature and extent of the habitats affected. It is anticipated that impacts to vegetation would be less than significant for all operational activities. Access roads and site configuration would not be changed for inspections or equipment servicing. Mowing and other site maintenance impacts would be less than significant because of their small scale and limited duration. If heavy equipment is used, or land clearing activities occur off established roads or corridors, there could be direct or indirect injury/mortality to plants. This may include loss, alteration, or fragmentation of vegetative communities, or introduction of invasive species. However these potential impacts are expected to be less than significant due to the limited extent and temporary 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.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from land/vegetation clearing, excavation, and paving activities due to the limited extent and temporary nature of the deployment. 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.

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 because of their small scale and 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 nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to terrestrial vegetation as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 16.1.6.3, Terrestrial Vegetation.

16.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in Utah are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle or vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 16.2.6-1, less than significant impacts would be anticipated given the anticipated small size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, impacts to individual behavior of animals would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Utah. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, preferred vegetation along roadways, areas of insect relief, and ease of travel along road corridors (FHWA, 2015j). 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. “Researchers reported an average of one ungulate (deer, elk, or antelope) per year was found tangled for every

2.5 miles of fence. The study stated that most animal fatalities occurred when the animals jumped or attempted to jump the fence and were caught in the top two wires" (BLM, 2010).

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and violate MBTA and BGEPA. Generally, collision events occur to "poor" fliers (e.g., ducks), night-migrating birds, heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans. (Gehring, J., Kerlinger, P. and A. Manville, 2011)

Avian mortalities or injuries could also result from vehicle strikes, although these 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 Utah are not likely to be widespread or affect populations of species as a whole; individual species impacts may occur on a localized basis depending on site-specific conditions and the nature of the deployment activity, but are generally expected to be less than significant due to the small scale and localized nature of expected activities. Potential impacts under MBTA and BGEPA could be addressed through BMPs and mitigation measures developed in consultation with USFWS. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

The majority of Utah's amphibian and reptile species are widely distributed throughout Utah. These species occur in a wide variety of habitats from the central plains in the south to moist hardwood forests in the north. Very few individual species are widespread throughout the state, and are instead more commonly found in areas near bodies of water, along sandy banks or open sandy soils, and within ponds and wetland areas, as turtles, frogs, and salamanders are attracted to these types of habitats. Limited direct mortality to amphibians or reptiles could occur in the relatively small construction zones where there is excavation or off-road vehicle traffic. These occurrences are expected to be small-scale and localized, affecting only individual animals.

Environmental consequences pertaining to Utah's one listed reptile, the desert tortoise, are discussed in Section 16.2.6.5, Threatened and Endangered Species and Species of Conservation Concern.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Utah 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. Habitat fragmentation is the loss or breaking down of continuous and connected habitat.

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 unusual 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 Utah's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Utah and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals that utilize these areas for foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures. Potential impacts from habitat loss on terrestrial mammals likely would be less than significant due to the limited extent and temporary nature of deployment activities.

Birds

The direct removal of migratory bird nests is prohibited under the MBTA. The USFWS and the UDWR provide 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, 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 will increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced if birds temporarily avoid IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, 1997).

The degree to which habitat exclusion affects birds depends on many factors. 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. Potential impacts from habitat loss on birds likely would be less than significant due to the limited extent and temporary nature of deployment activities. 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 Utah's amphibians and reptiles typically consist of wetlands and upland forests. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures could be implemented to avoid or minimize the potential 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.

Filling or draining of wetland breeding habitat (see Section 16.1.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to Utah's amphibian and reptile populations. Potential impacts from habitat loss on amphibians and reptiles likely would be less than significant due to the limited extent and temporary nature of deployment activities. BMPs and mitigation measures could help to avoid or minimize the potential impacts.

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 Utah as the state have over 10,000 species of invertebrates, including a wide variety of bees, hornets, wasps, butterflies, moths, beetles, flies, dragonflies, damselflies, spiders, mites, and nematodes (UDWR, 2015a). Impacts to sensitive invertebrate species are discussed below in Section 16.2.6.5, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.

Terrestrial Mammals

Stress from repeated disturbances during critical time periods (e.g., mating) could reduce the overall fitness and productivity of young and adult terrestrial mammals. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts due to the limited extent and temporary nature of the deployment.

Birds

Repeated disturbance, especially during the breeding and nesting season, could cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state 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, and repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed, however these impacts are expected to result in less than significant impacts due to the limited extent and temporary nature of the deployment.

Reptiles and Amphibians

Changes in water quality, especially during the breeding seasons, could cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed, however these impacts are expected to result in less than significant impacts due to the limited extent and temporary nature of the deployment.

Terrestrial Invertebrates

Terrestrial invertebrates could experience chronic stress, either by changes in habitat composition or competition for resources, resulting in lower productivity. Due to the large number of invertebrates distributed throughout the state, and given the short-term nature of most of the deployment activities, this impact would likely be less than significant.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. Potential effects to migration patterns of Utah's amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below.

Terrestrial Mammals

Large game animals have well-defined migratory routes. Route knowledge is passed on from one generation to the next and includes important feeding and calving areas. Small mammals also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula.[146] Any clearance, drilling, and construction activities needed for network deployment, including noise associated with these activities, has the potential to

[146] A location chosen by an animal for hibernation.

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 due to the limited extent and temporary nature of the deployment. 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 (which migrate through Utah) undertake some of the longest-distance migrations of all animals. According to the National Audubon Society, as of 2013, a total of 22 IBAs have been identified in Utah, including breeding range,[147] migratory stop-over, feeding, and over-wintering areas, and include a variety of habitats such as native grasslands, grasslands, sage brush, and wetland/ riparian[148] areas (National Audubon Society, 2013).

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 due to the limited extent and temporary nature of the deployment. BMPs and mitigation measures could help to further avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of salamanders and frogs are known to seasonally migrate. For example, Columbia spotted frogs (*Rana luteiventris*), located in the Wasatch Mountains and western desert of Utah, hibernate during the winter and then emerge from dormancy in spring and migrate to aquatic habitats (UDNR, 2006). 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 and impacts are expected to be less than significant due to the limited extent and temporary nature of the deployment. 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 Utah's terrestrial invertebrates are expected as a result of the Proposed Action.

[147] 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, 2015q).
[148] 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, 2015q).

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 burrows for small mammals, such as the prairie dog, and dens for large mammals, such as the black bear, has the potential to negatively affect body condition and reproductive success of mammals in Utah.

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 due to the limited extent and temporary nature of the deployment. 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. Impacts would be less than significant due to the limited extent and temporary nature of the deployment. BMPs and mitigation measures, as defined through consultation with USFWS or another appropriate regulatory agency, could be required to avoid or minimize impacts under the MBTA or BGEPA.

Reptiles and Amphibians

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 could help to avoid or minimize the potential impacts. For example, the spiny softshell turtle (*Apalone spinifera*) will lay its eggs in exposed soil in late spring or summer, where they could be exposed to vehicle traffic and other operational activities. Correspondingly, the reproductive success of the local population could be impacted (USGS, 2015j). Impacts are expected to be less than significant due to the limited extent and temporary nature of the deployment.

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. Utah has adopted regulations that prohibit or regulate the possession, transport, importation, sale, purchase, and introduction of select wildlife species (e.g., Aquatic Invasive Species Interdiction Act [Chapter 27]). The Natural Resources Conservation Service, Utah also maintains a list of non-native species that could pose a risk to cropland, rangeland, or wildlands; this list includes an amphibian species and four mammal species (NRCS, 2011).

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 Utah's wildlife are described below.

Terrestrial Mammals

FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations. "Invasive animals could affect surrounding species by eating them, consuming their food, competing for habitat, and introducing disease" (North Carolina State University, 2016). 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

FirstNet deployment activities could result in less than significant impacts to bird populations due to introduction of invasive species. Invasive plant (and plant seeds) and pest species (e.g., invasive insects) could 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. Potential impacts likely would be less than significant. 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

Invasive plants and other pest species could adversely alter or degrade native habitats (e.g., wetlands) used by reptiles and amphibians. "Invasive animals could affect surrounding species by eating them, consuming their food, competing for habitat, and introducing disease" (North Carolina State University, 2016). Although FirstNet 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 could pose a threat to Utah's forest and agricultural resources. The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive plant species during implementation of the Proposed Action. Invasive species effects related to terrestrial invertebrates are minimized following the BMPs and mitigation measures described below.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology,[149] 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 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.

[149] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

  - 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 because those activities would not require ground disturbance and if RF hazards are deemed insignificant.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g. reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Impacts may vary depending on the number or individual poles installed, but could include direct

injury/mortality as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.

- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could potentially impact wildlife (see Section 16.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/ mortality could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wildlife 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 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, and SOWs could result in direct injury/mortalities to wildlife on roadways. If

external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. RF hazards could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployment of drones, balloons, blimps, and piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be less than significant given the small scale of likely individual FirstNet projects; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individuals and would be unlikely to cause population-level impacts. The impacts of a 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 (e.g., application of herbicides or mowing), and periodic infrastructure replacement. Infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above-mentioned deployment impacts. Impacts to wildlife would depend on the scale of the activities (e.g., amount of land disturbance), ecoregion, species' phenology, and the nature and extent of the habitats affected.

It is anticipated that impacts to wildlife would be less than significant for all operational activities. Access roads and site configuration would not be changed for inspections or equipment servicing. Mowing and other site maintenance impacts would be less than significant because of their small scale. Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas. Direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. 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. 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. The impacts could vary greatly among species and geographic region. However, as with the Preferred Alternative, it is anticipated that impacts to wildlife would be less than significant for all operational activities. Access roads and site configuration would not be changed for inspections or equipment servicing. Mowing and other site maintenance impacts would be less than significant because of their small scale. Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas. Direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. 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. 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 16.1.6.4, Terrestrial Wildlife.

16.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in Utah are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (USEPA, 2012c)

Based on the impact significance criteria presented in Table 16.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although minimal, anthropogenic disturbances are expected to be measurable for some FirstNet projects. Direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed. Direct mortality/injury to fisheries and aquatic invertebrate populations likely would not occur as land clearing, excavation activities, and vehicle traffic would avoid aquatic habitats. The implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts to fisheries and aquatic invertebrate populations.

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, the 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. Impacts would be less than significant, as habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location depending on the nature of the deployment activity. Additionally, deployment activities with potential impacts to sensitive aquatic habitats could be addressed through BMPs and mitigation measures.

Indirect Injury/Mortality

Water quality impacts from exposure to contaminants from accidental spills from vehicles and equipment, and erosion or sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, streams, and other aquatic habitats could result in changes to habitat, food sources, or prey resulting in indirect mortality/ injury to fish and aquatic invertebrates. Indirect injury/mortality impacts vary depending on the species, time of year, and duration of deployment. Overall, these impacts are expected to be less than significant due to the limited extent and temporary 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.

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. The degree of impacts would vary depending on the species, time of year, and duration of deployment. However, overall, all impacts are expected to be less than significant, because they will be small scale and localized. 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 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 due to the limited extent and temporary 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.

Invasive Species Effects

FirstNet deployment activities could result in less than significant impacts to aquatic populations due to introduction of invasive species. The potential to introduce invasive plant (and plant seeds) and pest species (such as invasive insects, quagga mussel, and zebra mussel) within construction zones 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. 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. Impacts are expected to be less than significant due to the limited extent and temporary 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.

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,[150] 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

[150] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to fisheries and aquatic habitats because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have no impact on the aquatic environment.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development scenarios or 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 if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.

- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g. mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to fisheries and aquatic habitats. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and

could result in result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be less than significant because deployment activities are expected to be temporary, likely affecting only a small number of aquatic species. 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 (e.g., application of herbicides or mowing), and periodic infrastructure replacement. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above-mentioned 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 impacts to fisheries and aquatic habitats would be less than significant for all operational activities. Access roads and site configuration would not be changed for inspections or equipment servicing. Mowing and other site maintenance (e.g., pesticide application) impacts would be less than significant because of their small scale. Fisheries and aquatic invertebrates 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 aquatic 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. 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. 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.

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 extent and temporary 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.

Operational Impacts

Operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. Impacts could vary greatly among species and geographic region. 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, management, and monitoring, due to the limited extent and temporary 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.

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 16.1.6.5, Fisheries and Aquatic Habitats.

16.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Utah 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, BMPs and Mitigation Measures, 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 16.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes across the state, the potential impacts to threatened and endangered species addressed below are presented as a range of possible impacts.

Table 16.2.6-2: 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.	

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 16.2.6-2, 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, fish, invertebrates, and plants with known occurrence in Utah are described below. There are no listed amphibians in the state, therefore impacts to amphibians will not be discussed in this section.

<u>Terrestrial Mammals</u>

Two threatened mammal species are federally listed and known to occur in the state of Utah; they include the Canada lynx (*Lynx canadensis*) and Utah prairie dog (*Cynomys parvidens*). Direct mortality to the federally listed Canada lynx and Utah prairie dog could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Entanglement in fences or other barriers could also be a source of mortality or injury to this species. Impacts would likely be isolated, individual events.

Direct mortality to the federally listed Canada lynx could occur from vehicle strikes, as this species is occasionally found along transportation corridors. Entanglement in fences or other barriers could also be a source of mortality or injury to this species as well. Impacts would likely be isolated, individual events. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

<u>Birds</u>

One endangered and three threatened bird species are federally listed and known to occur in the state of Utah; they include the Gunnison sage-grouse (*Centrocercus minimus*), Mexican spotted owl (*Strix occidentalis lucida*), southwestern willow flycatcher (*Empidonax traillii extimus*), and the yellow-billed cuckoo (*Coccyzus americanus*). 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 potential disturbance or destruction of nests during ground disturbing activities. If proposed project sites are unable to avoid sensitive areas, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in

Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Fish

Seven endangered and two threatened fish species are federally listed and known to occur in the state of Utah: the bonytail chub (*Gila elegans*), Colorado pikeminnow (squawfish) (*Ptychocheilus lucius*), greenback cutthroat trout (*Oncorhynchus clarki stomias*), humpback chub (*Gila cypha*), June sucker (*Chasmistes liorus*), Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*), razorback sucker (*Xyrauchen texanus*), Virgin River chub (*Gila seminuda*), and the woundfin (*Plagopterus argentissimus*). Direct mortality or injury to these species could occur from vessel/boat strikes or entanglements resulting from the Proposed Action but are unlikely as the majority of FirstNet deployment projects would not occur in the aquatic environment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

One reptile species is federally listed and known to occur in the state of Utah, the desert tortoise (*Gopherus agassizii*). The majority of FirstNet deployment projects would not occur in an aquatic environment. Direct mortality or injury resulting from watercraft or vessel strikes is unlikely, as the majority of the FirstNet deployment projects would not occur in aquatic environments. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

No federally listed amphibians are known to occur in Utah. Therefore, no injury or mortality effects to federally threatened and endangered amphibians are expected as a result of the Proposed Action.

Invertebrates

One endangered invertebrate species is federally listed and known to occur in the state of Utah, the Kanab ambersnail (*Oxyloma haydeni kanabensis*). Direct mortality or injury could occur to this species if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by this species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Plants

Twelve endangered and thirteen threatened plant species are federally listed and known to occur in the state of Utah as summarized in Table 16.1.6-9. Three candidate species have been identified in the state; candidate species are not currently protected under the ESA, however, USFWS recommends conservation measures still be applied for these species. Direct mortality to federally listed plants could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce the breeding success of a listed species either by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which could affect the breeding success. Potential effects to federally listed terrestrial mammals, birds, terrestrial reptiles, fish, invertebrates, and plants with known occurrence in Utah are described below.

Terrestrial Mammals

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect federally listed terrestrial mammals, such as the Canada lynx (*Lynx canadensis*) or Utah prairie dog (*Cynomys parvidens*), in the vicinity of Project activities. Terrestrial mammals are mobile enough to avoid construction activities, utilize burrows, or defend nest or habitats and may relocate to less desirable locations for breeding and nesting. Impacts would be directly related to the frequency, intensity, and duration of these activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Birds

Noise, light, or human disturbance within nesting areas could cause federally listed birds, such as the Gunnison sage-grouse, (*Centrocercus minimus*), Mexican spotted owl (*Strix occidentalis lucida*), southwestern willow flycatcher (*Empidonax traillii extimus*), and the yellow-billed cuckoo (*Coccyzus americanus*), to relocate to less desirable locations, or cause stress to individuals reducing survival and reproduction. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect the federally listed reptile within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities. One reptile species, the desert tortoise (*Gopherus agassizii*), is federally listed. "Examples of direct threats [to the desert tortoise] include: collisions with motorized vehicles, illegal collecting, and disease.

Indirect threats likely affecting tortoise populations include: habitat loss from construction and agricultural development; habitat alterations from livestock grazing, recreational activities, atmospheric pollution, global warming, and invasions of exotic plants" (Boarman, 2016). 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

No federally listed amphibians are known to occur in Utah. Therefore, no reproductive effects to federally threatened and endangered amphibians are expected as a result of the Proposed Action.

Fish

Deployment activities resulting in increased disturbance (e.g., humans, noise), especially during spawning activity, and changes in water quality could cause stress resulting in lower productivity (see Section 16.2.4, Water Resources, for a discussion of potential impacts to water resources). Impacts to reproduction for federally listed fish species in Utah, such as the bonytail chub (*Gila elegans*), are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Degradation of wetland habitat from ground disturbing activities could cause stress resulting in lower productivity for the federally listed snail, the Kanab ambersnail, known to occur in Utah. Impacts associated with deployment activities are expected to result in less than significant changes to wetland quality. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Plants

No reproductive effects to federally listed plants are expected as a result of the Proposed Action as limited pesticides would be used and avoidance measures could be undertaken. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Behavioral Changes

Effects to normal behavior patterns that could lead to disruptions in breeding, feeding, or sheltering, resulting in take of a listed species would be considered potentially significant.

Potential effects to federally listed terrestrial mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Utah are described below.

Mammals

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect federally listed terrestrial mammals, including the Canada lynx (*Lynx canadensis*) or Utah prairie dog (*Cynomys parvidens*), within or in the vicinity of deployment activities. These disturbances could cause these species to avoid or abandon foraging and sleeping areas. Impacts would be directly related to the frequency, intensity, and duration of these deployment activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. The Central Flyway passes over Utah. The Central Flyway spans from the Gulf Coast of Texas to the Canadian boreal forest. Large numbers of migratory birds utilize the flyway and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall. Disturbance in stopover, foraging, or breeding areas or habitat loss/fragmentation could cause stress to individuals causing them to abandon areas for less desirable habitat. Activities related to the Proposed Action, such as aerial deployment or construction activities, could result in adverse effects to federally listed birds. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Noise, light, and other human disturbances associated with the Proposed Action could adversely affect the desert tortoise, the one federally listed reptile, within or in the vicinity of deployment activities. Habitat alteration could cause stress to the desert tortoise causing them to relocate to a different area (USFWS, 2014m). Impacts would be directly related to the frequency, intensity, and duration of these activities. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

No federally listed amphibians are known to occur in Utah. Therefore, no behavioral effects to federally threatened and endangered amphibians are 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 federally listed fish species in Utah. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species causing them to abandon spawning locations or altering migration patterns. Behavioral changes to listed fish 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. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in wetland habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for the federally listed Kanab ambersnail (*Oxyloma haydeni kanabensis*) resulting in lower productivity. Disturbances to food sources utilized by the federally listed terrestrial species, especially during the breeding season, could impact survival. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be potentially significant. Depending on the species or habitat, the adverse effect threshold would vary. FirstNet activities are generally expected to be small-scale in nature, therefore large-scale impacts are not expected; however, it is possible that small-scale changes could lead to potentially significant adverse effects for certain species. For example, impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically.

Terrestrial Mammals

No designated critical habitat occurs for terrestrial mammals in Utah. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Birds

All four of the federally listed birds in Utah have federally designated critical habitat. Critical habitat for the Gunnison sage-grouse was designated in Grand and San Juan counties. Critical habitat for the Mexican spotted owl was designated in Carbon, Emery, Garfield, Grand, Iron, Kane, San Juan, Washington, and Wayne counties. Critical habitat for the southwestern willow flycatcher was designated in Kane, San Juan, and Washington counties. Critical habitat for the yellow-billed cuckoo was designated in Uintah, Duchesne, Grand, San Juan, Wayne, and Washington counties.

Land clearing, excavation activities, and other ground disturbing activities in these regions of Utah could lead to habitat loss or degradation, which could lead to adverse effects to the these birds 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. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

The only federally listed reptile species in Utah has federally designated critical habitat. Critical habitat for the desert tortoise was designated in the Mojave Desert region of Utah. Land clearing, excavation activities, and other ground disturbing activities in this region of Utah could lead to habitat loss or degradation, which could lead to adverse effects to this species 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. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

There are no federally listed amphibians and no designated critical habitat for amphibians in Utah. Therefore, no effect to threatened and endangered amphibians from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Fish

Seven of the federally listed fish species in Utah have federally designated critical habitat. Critical habitat for the bonytail chub was designated in the Green and Colorado Rivers in Uintah, Grand, Garfield, and San Juan counties. Critical habitat for the Colorado pikeminnow squawfish was designated along the Green, Colorado, and Yampa rivers in Uintah, Carbon, Grand, Emery, Wayne, and San Juan counties. Critical habitat for the humpback chub was designated along the Green and Colorado Rivers in Uintah, Grand, Garfield, and San Juan counties. Critical habitat for the June sucker was designated from Utah Lake to the Provo River. Critical habitat for the razorback sucker was designated in in the Green, White, Colorado, and Duchesne rivers in Uintah, Carbon, Garfield, Grand, Emery, Wayne, and San Juan counties. Critical habitat for the Virgin River chub was designated in portions of the Virgin River in Washington County. Critical habitat for the woundfin was designated along portions of the main stem of the Virgin River and its associated 100-year floodplain. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the greenback cutthroat trout or Lahontan cutthroat trout in Utah; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Invertebrates

No designated critical habitat occurs for the Kanab ambersnail (*Oxyloma haydeni kanabensis*) in Utah. Therefore, no effect to threatened and endangered invertebrates from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Plants

Of the 25 federally listed plant species in Utah, 5 of them have federally designated critical habitat in Utah. Critical habitat for the Gierisch mallow (*Sphaeralcea gierischii*) was designated at Starvation Point in Washington County. Critical habitat for the Heliotrope milk-vetch (*Astragalus montii*) was designated on western Heliotrope Mountain in Sanpete County. Critical habitat for the Holmgren milk-vetch (*Astragalus holmgreniorum*) was designated in 23 units in Washington County. Critical habitat for the Shivwits milk-vetch (*Astragalus ampullarioides*) was designated in 5 units of Washington County. Critical habitat for the Welsh's milkweed (*Asclepias welshii*) was designated on the Coral Pink Sand Dunes and the Sand Hills in Kane County. The Navajo sedge (*Carex specuicola*) has designated critical habitat, but none that occurs in Utah.

Land clearing, excavation activities, and other ground disturbing activities in this region of Utah could lead to habitat loss or degradation, which could lead to adverse effects to these plants 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. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed plant species in Utah; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology,[151] and the nature and extent of the habitats affected.

Activities Likely to Have No Effect

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 threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened and endangered because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide, interoperable, public safety broadband network. Therefore, unless this decision changes, there would be no effect to threatened and endangered 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 development scenarios or 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

[151] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

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., small mammals, and young), that utilize burrows, or that are defending nest sites. Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat if BMPs and mitigation measures are not implemented.

  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat to threatened and endangered species. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no impacts to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are

required, impacts could be similar to new wireless construction. Hazards related security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployment of drones, balloons, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the above mentioned 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 to adversely affect protected species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above mentioned 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 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected, by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species through direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that activities may affect, but are not likely to adversely affect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no 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 16.1.6.6.

16.2.7. Land Use, Recreation, and Airspace

16.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Utah 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.

16.2.7.2. 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 16.2.7-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to land use, recreation, and airspace resources addressed in this section are presented as a range of possible impacts.

Table 16.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception.	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA
Indirect land use change	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses.	Effect that is potentially significant, but with mitigation is less than significant.	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses.	No conflicts with adjacent existing or planned land uses.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities.	Effect that is potentially significant, but with mitigation is less than significant.	Restricted access to recreation land or activities	No disruption or loss of access to recreational lands or activities
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites.	Effect that is potentially significant, but with mitigation is less than significant.	Small reductions in visitation or duration of recreational activity.	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace.	Effect that is potentially significant, but with mitigation is less than significant.	Alteration to airspace usage is minimal.	No alterations in airspace usage or flight patterns.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Airspace altered indefinitely.		Short-Term: Airspace altered for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

16.2.7.3. 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 16.2.7-1, 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 16.2.7-1, less than significant impacts would be anticipated as any new land use would be small scale; only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

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 16.2.7-1, less than significant impacts would be anticipated as any new land use would be small scale and loss of access to public or private recreation lands or activities would be temporary; only short-term impacts 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 16.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations of visits 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 16.2.7-1, 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 likely impact airspace resources.

16.2.7.4. *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 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 land use, recreation, and airspace resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - <u>Land Use</u>: See Activities Likely to Have Impacts below.
    - <u>Recreation</u>: See Activities Likely to Have Impacts below.
    - <u>Airspace</u>: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - <u>Land Use</u>: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - <u>Recreation</u>: See Activities Likely to Have Impacts below.
    - <u>Airspace</u>: It is anticipated that there would be no impacts to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace.
  - 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.
    - <u>Land Use</u>: See Activities Likely to Have Impacts below.

    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.
  - Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
    - Airspace: No impacts are anticipated to airspace from collocations.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
    - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
    - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
    - Airspace: Lighting of dark fiber would have no impacts to airspace.
  - New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
    - Land Use: See Activities Likely to Have Impacts below.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: The installation of cables in limited nearshore and inland bodies of water and construction of landings/facilities would not impact flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, Safe, Efficient Use, and Preservation of the Navigable Airspace.
  - 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: If installation of transmission equipment would occur in existing boxes or huts there would be no impacts to existing and surrounding land uses.
    - Recreation: If installation of transmission equipment would occur in existing boxes or shelters there would be no impacts to recreation.
    - 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: 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: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet Aboveground Level (AGL) or do not trigger any of the other FAA obstruction to airspace criteria.
- 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 or deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Airspace: No impacts are anticipated – see previous section.
    - 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.
  - New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
    - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed ROWs or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: No impacts are anticipated – see previous section.
  - New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore and inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.

        - Airspace: No impacts are anticipated – see previous section.
    - 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 Utah's airports.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
        - Land Use: No impacts are anticipated – see previous section.
        - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
        - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airportsor air navigation facilities.

- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: See Activities Likely to Have Impacts below.
    - Recreation: See Activities Likely to Have Impacts below.
    - Airspace: Implementation of Deployable Aerial Communications Architecture could result in temporary or intermittent impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near Utah airports. Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, untethered balloons and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the above mentioned 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 could include obstructions to airspace or affect flight profiles and operating parameters of SUAs/MTRs. These impacts are expected to be less than significant due to the limited extent and temporary 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 infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above mentioned 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 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 16.2.8, 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; however, impacts are anticipated to be less than significant due to the short-term natures of the 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.

16.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use. While a single deployable technology may have an 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. Also, implementation of deployable technologies could result in less than significant impacts to airspace if deployment does trigger any obstruction criterion or result in changes to flight patterns and airspace restrictions. Impacts are anticipated to be less than significant due to the limited extent and temporary 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 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 limited extent and temporary 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.

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 16.10, Land Use, Recreation, and Airspace.

16.2.8. Visual Resources

16.2.8.1. Introduction

This section describes potential impacts to visual resources in Utah 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.

16.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 16.2.8-1. As described in Section 16.2, 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 16.2.8-1: 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.

16.2.8.3. 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 Utah, residents and visitors travel to visit the mountains and ski resorts 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.

Based on the impact significance criteria presented in Table 16.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered potentially significant if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. Given the small scale of likely FirstNet activities, impacts are expected to be less than significant.

Nighttime Lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility that caused regional impacts or permanent changes to night sky conditions, those effects could be considered potentially significant.

Based on the impact significance criteria presented in Table 16.2.8 1, lighting that illuminates the night sky, diminishes night sky viewing over long distances, and persists over the long-term could be considered potentially significant. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience potentially significant impacts to night skies, although potentially minimized to less than significant with implementation of BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented.

16.2.8.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting and pole replacement would be limited.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to visual resources since the activities would be conducted at small entry and exit points and are not likely to produce perceptible changes and would not require nighttime lighting.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to visual resources because there would be no ground disturbance, would not require nighttime lighting, and would not produce any perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have no impact on visual resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects

- New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to visual resources. The degree of impact would depend on the timing, location, and type of project; installation of a hut or POP would be permanent, whereas ground disturbing activities would be short-term. In most cases, development located next to existing roadways would not affect visual resources unless vegetation were removed or excavation occurred in scenic areas.
- New Build – Aerial Fiber Optic Plant: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public ROWs would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if the onsite delivery of additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if

the implementation requires minor construction of staging or landing areas, results in vegetation removal, areas of surface disturbance, or additional nighttime lightning.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant due to the limited extent of the deployment, although certain discrete locations could have potentially greater impacts to night skies or as a result of new towers. 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 above mentioned construction impacts. It is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park would be less than significant with BMPs and mitigation measures incorporated during operations. Additionally, FirstNet would work closely with the National Park Service (NPS) to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

16.2.8.5. 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 due to the limited extent and temporary 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 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 due to the limited extent and temporary nature of the deployment. 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. 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 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 16.1.8, Visual Resources.

16.2.9. Socioeconomics

16.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Utah 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.

16.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 16.2.9-1. As described in Section 16.2, 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 16.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible impact to property values and/or rental fees.	No impacts to real estate in the form of changes to property values or rental fees.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes to spending, income, industries, and public revenues Economic benefits or adverse impacts related to changes in tax revenues, wages, major industries, or direct spending (could be positive or negative)	Magnitude or Intensity	Economic change that constitutes a market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible economic change.	No change to spending, income, industries, and public revenue.
	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

16.2.9.3. Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts related to Changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values due to below average public safety communication services. Improved services would reduce response times and improve responses. These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Existing Environment, property values vary across Utah. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $287,000 in the Heber area, to between $162,000 to $167,000 in Cedar City, Hurricane, and Tooele. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts Related to changes in Spending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and partners 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, 2006a). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's partner(s) may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

FirstNet may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment is a direct, beneficial impact of expenditures on FirstNet. Additional, indirect employment increases would occur as additional businesses hire workers to provide supporting goods and services. For instance, FirstNet partner(s) and their subcontractors and vendors would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and less than significant. However, even small employment 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 Utah. The average annual unemployment rate in 2014 was 3.8 percent, considerably lower than the national rate of 6.2 percent. Most counties had unemployment rates below the national average (that is, better employment performance). However, four counties in the sparsely populated, southeastern part of the state had unemployment rates above the national average.

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 16.2.9-1 because they would not constitute a "high level of job creation at the state 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.

16.2.9.4. 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 they represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 16.2.9-1.

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 summarizes how the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate;
- Changes to Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Expenditures for these projects would temporarily generate 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 – Expenditures for these projects would temporarily generate 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 – Expenditures for these projects would temporarily generate a less than significant number of jobs regionally and statewide.

- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Expenditures for these projects would temporarily generate 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 – Expenditures for these projects would temporarily generate 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 – Expenditures for these projects would temporarily generate 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 – Expenditures for these projects would temporarily generate 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 – Expenditures for these projects would temporarily generate a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant.

    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Expenditures for these projects would temporarily generate 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 – Expenditures for these projects would temporarily generate 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 due to the limited extent and temporary duration of 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.

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 are also potential concerns in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts are expected to be less than significant due to the limited extent 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.

16.2.9.5. 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, although less than significant based on the significance criteria table. Impacts are anticipated to be less than significant due to the limited extent and temporary nature of the deployment.

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 adverse impacts of new wireless communication towers on property values would be avoided under the Deployable Technologies 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.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and while small individually, would be important at a larger scale, although less than significant. Impacts are anticipated to be less than significant due to the limited extent and temporary nature of the deployment.

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. However, under this Alternative, it is anticipated that impacts will be less than significant due to the limited extent and temporary 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.

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 16.1.9, Socioeconomics.

16.2.10. Environmental Justice

16.2.10.1. Introduction

This section describes potential impacts to environmental justice in Utah 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.

16.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 16.2.10-1. As described in Section 16.2, 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 16.2.10-1: 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

16.2.10.3. 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. American 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.

Environmental justice populations are often highly localized. 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 16.1.10.4) as having Moderate Potential or High Potential for environmental justice populations would particularly warrant further screening. As discussed in Section 16.1.10.3, Environmental Setting: Minority and Low-Income Populations, Utah has a higher percentage of Hispanic population than the region but a lower percentage than the nation. Its percentage of All Minorities is lower than that of the region and considerably lower than that of the nation. The poverty rate in Utah is considerably lower than the rates for the region and the nation. Utah has many areas with High Potential for environmental justice populations. The distribution of these High Potential areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations, including some of the state's most sparsely populated areas. The distribution of areas with Moderate Potential for environmental justice populations is also fairly even across the state. Further analysis using the data developed for the screening analysis in Section 16.1.10.3, 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 could use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

16.2.10.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand holes, pulling vaults, junction boxes, huts, and POP structures. Activities at these small entry points would be limited and temporary and thus are not likely to produce perceptible changes affecting any

surrounding communities. Therefore, they would not affect environmental justice communities.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and therefore would have no impacts to environmental justice. If physical access is required to light dark fiber, it would likely be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts on environmental justice communities.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance and impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice, it is anticipated that this activity would have no impact on environmental justice.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures. These activities could temporarily generate noise and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Aerial Fiber Optic Plant: Pole/structure installation could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore to accept submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur

disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than significant, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects could help determine potential impacts to specific environmental justice communities. 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

Activities to Have No Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. It is anticipated that such activities would not result in environmental justice impacts, as the intensity of these activities would be low (low potential for objectionable effects such as noise and dust) and their duration would be very short. Routine maintenance and inspection would not adversely affect property values, for the same reasons.

Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above mentioned deployment activities that involve construction.

Impacts are expected to be less than significant due to the limited extent and temporary 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.

16.2.10.5. 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 due to the limited extent and temporary 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

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 due to the limited extent and temporary 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.

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 16.1.10, Environmental Justice.

16.2.11. Cultural Resources

16.2.11.1. Introduction

This section describes potential impacts to cultural resources in Utah 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

16.2.11.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 16.2.11-1. 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 cultural resources addressed in this section are presented as a range of possible impacts.

Table 16.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	Mitigated Adverse Effect[1]	Effect, but Not Adverse	No Effect
Physical damage to and/or destruction of historic properties[2]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
	Geographic Extent	Direct effects APE.		Direct effects APE.	Direct effects APE.
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties.		Permanent direct effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
Indirect effects to historic properties (i.e. visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a contributing or non-contributing portion of a single or many historic properties.	No indirect effects to historic properties.
	Geographic Extent	Indirect effects APE.		Indirect effects APE.	Indirect effects APE.
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties.		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties.	No indirect effects to historic properties.
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct or indirect effects to historic properties.
	Geographic Extent	Direct and/or indirect effects APE.		Direct and/or indirect effects APE.	Direct and/or indirect effects APE.

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	Mitigated Adverse Effect[1]	Effect, but Not Adverse	No Effect
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties.		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties.	No direct or indirect effects to historic properties.
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No segregation or loss of access to historic properties.
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties.		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties.	No segregation or loss of access to historic properties.
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties.		Infrequent, temporary, or short-term changes in access to a single or many historic properties.	No segregation or loss of access to historic properties.

[1] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/THPO and other consulting parties, including Indian Tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[2] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian Tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

16.2.11.3. 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 16.2.11-1, 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 Utah, some deployment activities may be in these areas, in which case BMPs, as defined through consultation with the appropriate resource agency, could help avoid or minimize the potential impacts. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize 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. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Loss of Access to Historic Properties

The deployment of equipment requiring a secure area has the potential to cause the loss of access to historic properties. The highest potential for this type of significant impact would be from the deployment of equipment in secure areas that impact the access to sites of cultural importance to Native Americas. 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.

16.2.11.4. 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 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 cultural resources, while others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to cultural resources since the activities that would be conducted at these small entry and exit points are not likely to produce impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to cultural. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would also have no impacts to cultural resources because there would be no ground disturbance and no perceptible visual changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create perceptible visual effects.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact cultural resources, it is anticipated that this activity would have no impact on cultural resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including the destruction of artifacts. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could impact cultural resources where there potential to contain archaeological sites. Impacts to cultural resources could also potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable, which could result in the disturbance of archaeological 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 Salt Lake 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 effect, but not adversely effect, cultural resources. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further 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 above mentioned 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. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

16.2.11.5. 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 effect, but not adversely effect, cultural resources. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further 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 not adverse to historic properties associated with implementation/running of the deployable technology because effects to access or the viewshed could occur, depending on the length of deployment. 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. 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, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no 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 Section16.1.11, Cultural Resources.

16.2.12. Air Quality

16.2.12.1. Introduction

This section describes potential impacts to Utah'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.

16.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Utah's air quality were evaluated using the significance criteria presented in Table 16.2.12-1. As described in Section 16.2, 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 Utah's air quality addressed in this section are presented as a range of possible impacts.

Table 16.2.12-1: Impact Significance Rating Criteria for Utah

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

16.2.12.3. Description of Environmental Concerns

Increased Air Emissions

The Proposed Action has the potential to generate air pollutant emissions. These emissions could be above and beyond what is typically generated in a given area and may alter ambient air quality. Deployment activities may involve the use of vehicles, heavy equipment, and other equipment that could emit exhaust and create fugitive dust in localized areas. During operations, routine maintenance and other use of generators at tower facilities may emit exhaust for specific durations (maintenance) or unpredictable timeframes (if power is lost to a site, for example). Impacts are likely to be less than significant due to the mobile nature of the sources and the temporary and short-term duration of deployment activities. Although unlikely, the emissions of criteria pollutants could impair the air quality of the region and potentially affect human health. Potential impacts to air quality from emissions may occur in areas where the current air quality exceeds, or has a history of exceeding, one or more NAAQS. Areas exist in Utah that are in maintenance or nonattainment for one or more criteria pollutants (see Section 16.1.12, Air Quality and Figure 16.1.12-1). The majority of the counties in Utah are designated as maintenance areas for PM and SO_2 (Table 16.1.12-3); counties located in the northern portion of the state are designated nonattainment or maintenance for two NAAQS pollutants (Figure 16.1.12-1).

Based on the significance criteria presented in Table 16.2.12-1, air emission impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of emission sources be deployed/operated long-term in the same area from fixed or mobile sources or construction activities. Less than significant emissions could occur for any of the criteria pollutants within attainment areas in Utah; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present in Utah (Figure 16.1.12-1), FirstNet would try to minimize potential emissions where possible. 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.

16.2.12.4. Potential Impacts of the Preferred Alternative

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

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, 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 scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in fugitive dust and products of combustion from the use of vehicles and heavy equipment.

- New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment could result in products of combustion from the use of vehicles and machinery, as well as fugitive dust emissions from site preparation.
- Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in products of combustion from the use of vehicles and heavy equipment, as well as fugitive dust from site preparation.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could generate products of combustion from vessels used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.

- Wireless Projects
    - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
    - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If additional power units, structural hardening, and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
    - Deployable Technologies: The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be less than significant due to the limited extent and temporary 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.

16.2.12.5. 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. 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 to ambient air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

16.2.13. Noise

16.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and alternatives in Utah. 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.

16.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 16.2.13-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential noise impacts to Utah addressed in this section are presented as a range of possible impacts.

Table 16.2.13-1: Impact Significance Rating Criteria for Noise

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased noise levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific state noise limits. Noise levels plus baseline noise levels would exceeds 10 dBA increase from baseline noise levels (i.e., louder). Project noise levels near noise receptors at National Parks would exceed 65 dBA.	Effect that is potentially significant, but with mitigation is less than significant.	Noise levels resulting from project activities would exceed natural sounds, but would not exceed typical noise levels from construction equipment or generators.	Natural sounds would prevail. Noise generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.
	Geographic Extent/Context	County or local.		County or local.	County or local.
	Duration or Frequency	Permanent or long-term.		Short term.	Temporary.

NA = Not Applicable

16.2.13.3. 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 fewer long-term effects from operational use of the proposed equipment.

Based on the significance criteria presented in Table 16.2.13-1, noise impacts would likely be less than significant given the size, duration, and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of noise sources be deployed/operated long-term in the same area. Noise levels from deployment activities are not expected to exceed typical noise levels for short-term/temporary construction equipment or generators.

To the extent practicable, FirstNet would attempt to mitigate or minimize noise effects during construction or operation. BMPs and mitigation measures would be followed to limit impacts on nearby noise-sensitive receptors. However, given that much of the concentration and setup of equipment would often occur in populated areas, FirstNet operations would not be able to completely avoid noise impacts due to construction and operations at various receptors.

16.2.13.4. 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 development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no noise impacts under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction or installation activities, and therefore would have no noise impacts.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The duration of construction activities associated with installing permanent equipment on existing structures would most likely be short-term. It is anticipated that insignificant levels of noise would be emitted during installment of this equipment. Noise caused by these construction and installation activities would be similar to other construction activities in the area, such as the installation of cell phone towers or other communication equipment. Deployment and operation of satellite-enabled devices and equipment are expected to have minimal to no impact on the noise environment.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential for Noise Impacts

Construction, deployment, and operation activities related to the Preferred Alternative could create noise impacts from either the construction or operation of the infrastructure. The types of infrastructure deployment scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber as well as land/vegetation clearing, excavation activities, and landscape grading could result in high noise levels from the use of heavy equipment and machinery.
  - New Build – Aerial Fiber Optic Plant: The use of heavy equipment during the installation of new poles and hanging cables, as well as constructing access roads, POP huts, or other associated facilities to house plant equipment would be short-term and could result in increased noise levels from the use of vehicles and machinery.
  - Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in higher noise levels from the use of heavy equipment and machinery.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Installation of new associated huts or equipment, if required, could result in short-term and temporarily higher noise levels if the activity required the use of heavy equipment for grading or other purposes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited nearshore and inland bodies of water could generate noise if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be less than significant due to the limited extent and temporary 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

Operation activities associated with the Preferred Alternative would be less than significant and similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above mentioned 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.

16.2.13.5. 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 have a cumulative impact of potential significance. 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 would likely be deployed to areas with low amounts of existing facilities, so noise impacts would be minimal in these areas. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above mentioned 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 for 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. Any residential areas or other noise-sensitive receptors under the flight path of these vehicles would experience less than significant, short-term impacts. 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 to ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

16.2.14. Climate Change

16.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Utah 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.

16.2.14.2. 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 16.2.14-1. As described in Section 16.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to climate and climate change-vulnerable resources addressed in this section are presented as a range of possible impacts.

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or alternatives. The second is 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 (EPA, 2015), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the proposed action is more general. In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2014). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process could provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 16.2.14-1: 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

16.2.14.3. Projected Future Climate

The Southwest is the hottest and driest region in the U.S. The decade 2001-2010 was the warmest in the 110-year instrumental historical record keeping, with temperatures almost 2 °F higher than historic averages, which included fewer cold air outbreaks and more heat waves. Summertime heat waves are projected to become longer and hotter, whereas the trend of decreasing wintertime cold air outbreaks is projected to continue. These changes will directly affect urban public health and will also have direct impacts on crop yields (USGCRP, 2014a).

Air Temperature

Figure 16.2.14-1 and Figure 16.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Utah from a 1969 to 1971 baseline.

Csa **–** Figure 16.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the Csa region of Utah under a low emissions scenario would increase by approximately 5 °F, and by the end of the century (2080 to 2099) under a low emissions scenario temperatures in the entire state of Utah would increase by approximately 6° F. (USGCRP, 2009a)

Figure 16.2.14-2 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 Csa region of Utah, temperatures would increase by approximately 10° F. (USGCRP, 2009a)

Bsk **–** Under a low emissions scenario, temperatures in Utah are expected to increase by 4 or 5 °F depending on the portion of the Bsk region by mid-century, and by the end of the century temperatures are expected to increase by 6 °F. (USGCRP, 2009a)

Temperatures in the Bsk region of Utah under a high emissions scenario are expected to increase by 5 °F by mid-century, and by the end of the century temperatures are expected to change by 9 or 10 °F depending on the portion of the Bsk region. (USGCRP, 2009a)

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) under a low emissions scenario at the same rate as the Bsk region. (USGCRP, 2009a)

Temperatures under a high emissions scenario are expected to change at the same rate as the Csa region for mid-and-end of century. (USGCRP, 2009a)

Dfc **–** Temperatures in this region are expected to increase under a low emissions scenario by mid-century (2040 to 2059) by approximately 4 °F, and by the end of the century by 6 °F. (USGCRP, 2009a)

Temperatures under a high emissions scenario are expected to change at the same rate as the Csa and Dfb regions for mid-and-end of century. (USGCRP, 2009a)

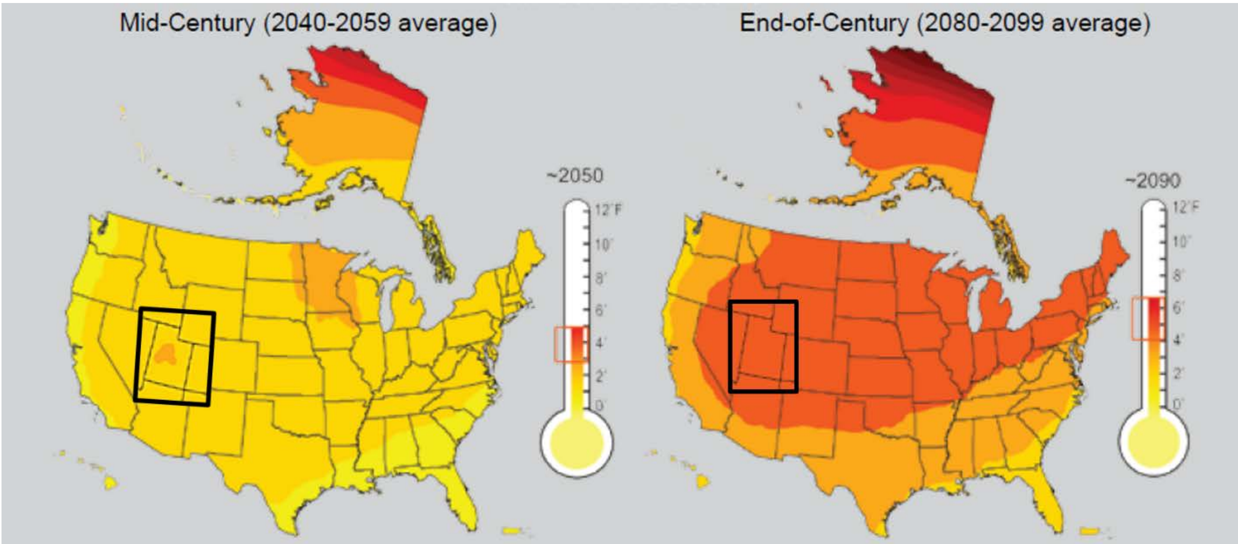

Figure 16.2.14-1: Utah Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009b)

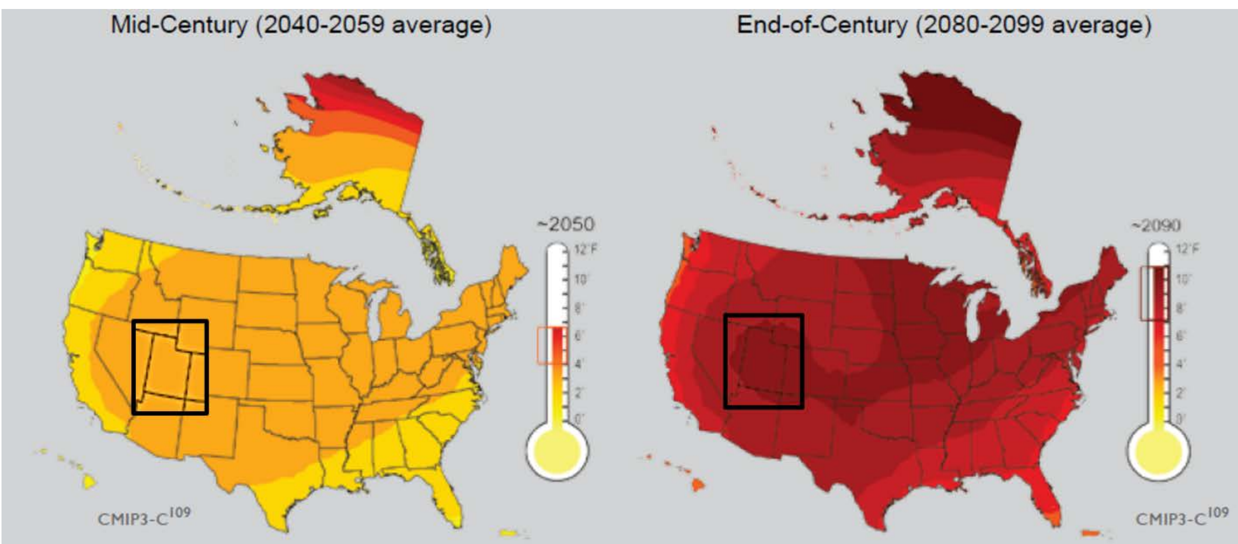

Figure 16.2.14-2: Utah High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009a)

Precipitation

Precipitation projections are less certain than those for temperature. Under a high emissions scenario, reduced winter and spring precipitation is consistently projected for the southern part of the Southwest by 2100. In the northern part of the region, projected winter, spring, summer and fall precipitation changes are smaller than natural variations. The Southwest is prone to drought, with future droughts projected to be substantially hotter. In addition, droughts along major river basins, such as the Colorado River Basin, are projected to become more frequent, intense, and longer lasting. These drought conditions present a huge challenge for water resource management and natural hazards such as wildfire. (USGCRP, 2014a)

Total seasonal snowfall has generally decreased in southern and some western areas 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 Northern and Western Utah, there is an expected decrease in the number of consecutive dry days while in Southern Utah, there is an expected increase 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). In a high emissions scenario, all areas of Utah would see an increase in the number of consecutive dry days. An increase in consecutive dry days could lead to drought. (USGCRP, 2014b)

Figure 16.2.14-3 and Figure 16.2.4-4 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 16.2.14-3 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 16.2.4-4 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)

Csa - Figure 16.2.4-4 shows that in a rapid emissions reduction scenario in the 30-year period for 2071 to 2099, precipitation is not expected to change in winter, summer or fall for the Csa region of Utah. However, in spring precipitation is expected to increase by 10 percent under this low emissions scenario in the Csa region. (USGCRP, 2014b)

Figure 16.2.4-4 shows that if emissions continue to increase, winter precipitation is expected to increase as much as 20 percent over the period 2071 to 2099. In spring, precipitation in this scenario could increase as much as 20 percent. No significant change to spring, summer or fall precipitation is anticipated over the same period. (USGCRP, 2014b)

Bsk – Under a low emissions scenario, winter and fall precipitation are not projected to have any changes in precipitation other than natural variability. In spring and summer, precipitation could increase as much as 10 percent in the Bsk region of Utah depending on the area of the region while in other portions of this region there are no projected changes in spring and summer precipitation. (USGCRP, 2014b)

Winter precipitation is expected to increase 10 or 20 percent under a high emissions depending on the portion of the Bsk region. In spring, precipitation is projected to increase or decrease 10 percent depending on the areas of the region while some other areas of the Bsk region in spring will have no changes. In summer, precipitation is expected to increase 10 or 20 percent depending on the portion of the region while some other areas will have no changes. No significant change to fall precipitation is anticipated over the period. (USGCRP, 2014b)

Dfb – Precipitation is not expected to change in winter, summer or fall for the Dfb region of Utah under a low emissions scenario. In spring, precipitation in this scenario could increase 10 percent depending on the area of the region while some other areas of the region are not expected to have any changes in precipitation. (USGCRP, 2014b)

Under a high emissions scenario, spring precipitation is expected to increase as much as 20 percent. In spring, precipitation is projected to increase or decrease 10 percent depending on the areas of the region while some other areas of the Dfb region in spring will have no change. Summer precipitation is expected to increase up to 10 percent or have no change depending on the area of the Dfb region. No significant change to fall precipitation is anticipated over the period.

Dfc – Precipitation is not expected to change in winter or fall for the Dfc region of Utah under a low emissions scenario. In spring and summer, precipitation is anticipated to increase 10 percent. (USGCRP, 2014b)

Under a high emissions scenario, precipitation is not expected to change in summer or fall for the Dfc region of Utah. In winter, precipitation is expected to increase as much as 20 percent under a high emissions scenario and 10 percent in spring. (USGCRP, 2014b)

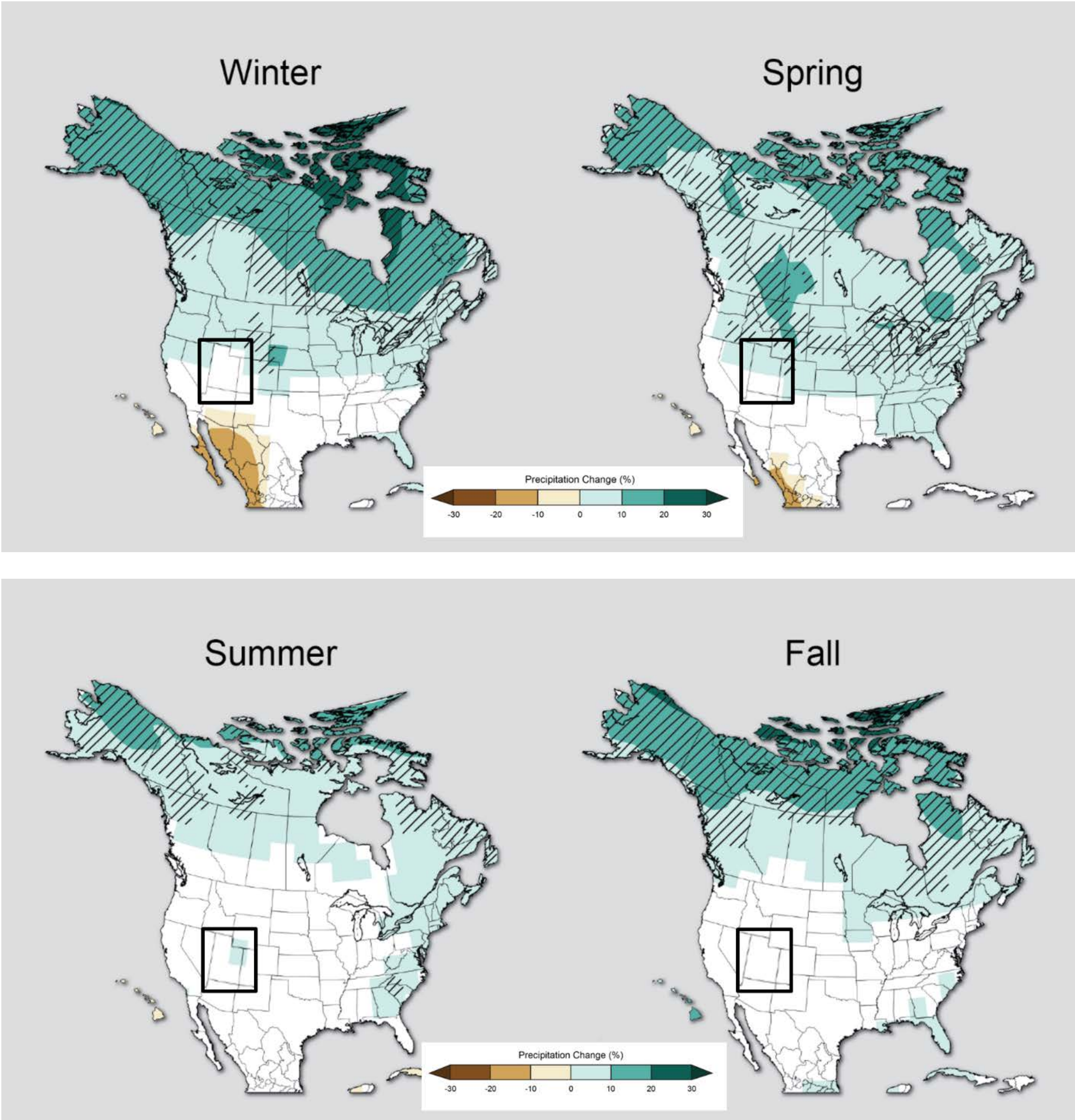

Figure 16.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

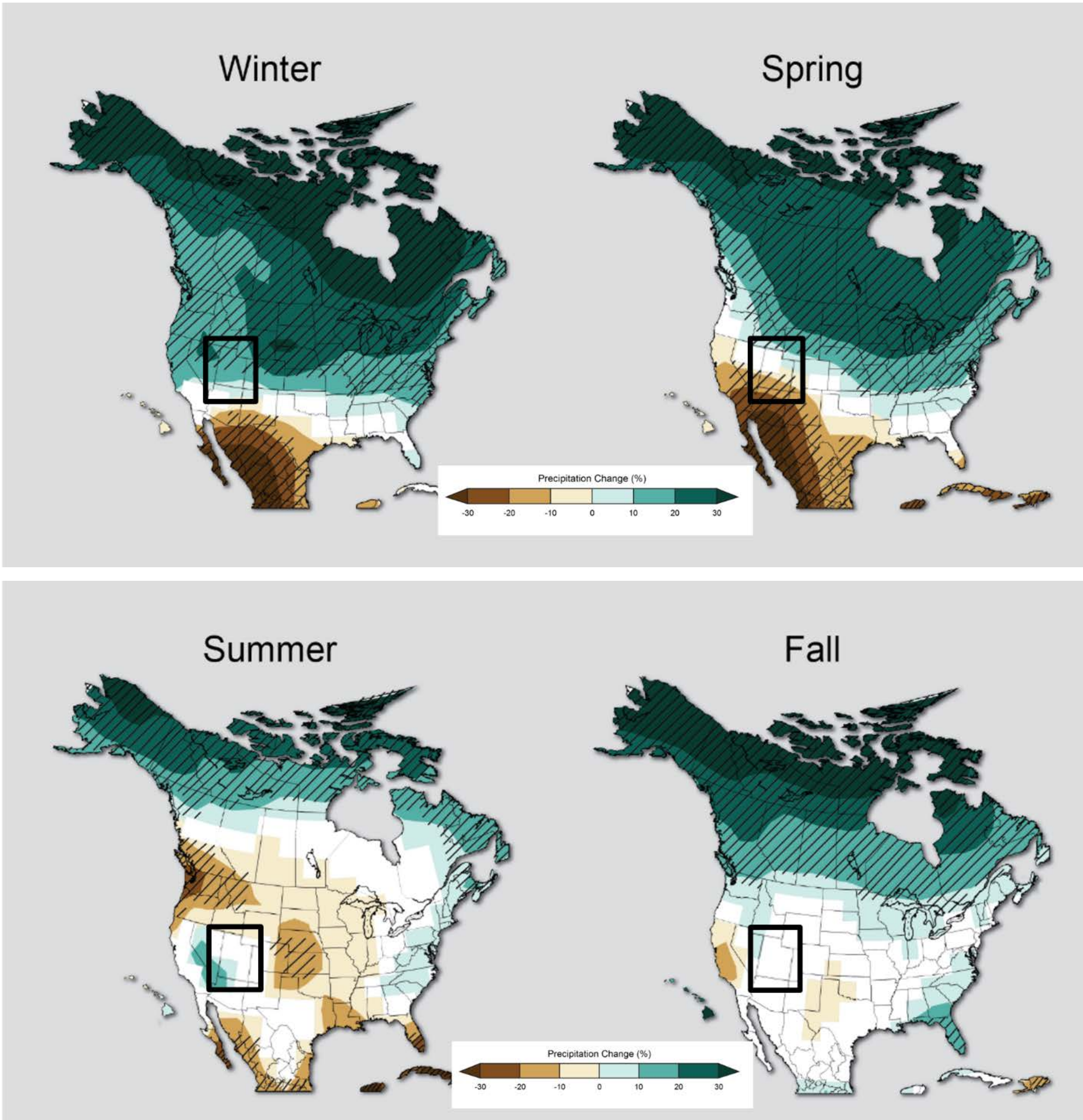

Figure 16.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2014b)

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)

16.2.14.4. Description of Environmental Concerns

Greenhouse Gas Emissions

Increases in GHG emissions have altered the global climate, leading to generalized temperature increases, weather disruption, increased droughts and heatwaves, and may have potentially catastrophic long-term consequences for the environment. Although GHGs are not yet regulated by the federal government, many states have set various objectives related to reducing GHG emissions, particularly CO_2 emissions from fossil fuels.

Based on the impact significance criteria presented in Table 16.2.14-1, 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. For example, a standard 60kW 3-phase diesel generator running full-loaded consumes approximately 4.0 to 5.0 gallons of diesel per hour. Diesel fuel combustion emits 22.38 lbs of CO_2 per gallon (EIA, 2015c). Therefore, in this example, a 60kW transmitter running on a generator would 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, 2015u), the same transmitter would be responsible for approximately 271 MT of CO_2 per year running continuously. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Willem Vereecken, 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Project-Related Resource Effects

Climate change may impact project-related effects by magnifying or otherwise altering impacts in other resources areas. For example climate change may impact air quality, water resource availability, and recreation.

The severity and length of droughts is expected to increase in Utah as snow pack is reduced and temperatures rise (USGCRP, 2014e). This in turn may contribute to more frequent and larger wildland fires (USGCRP, 2014d) as well as increased fuel load in the form of dead trees caused by invasive bark beetles (USFS, 2015b), which over the long term may have a transformative effect on forest ecosystems. Climate change may expose areas of Utah to increased intensity and duration of heat waves (USGCRP, 2014f), although Utah does not have the large population centers with significant urban heat islands that many other states have, with the possible exception of Salt Lake City (EPA, 2002) that would greatly magnify these effects.

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.

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.

Extended periods of extreme heat may increase general demand on the electric grid in the mountain states, impede its operation (DOE, 2015), and overwhelm the capacity onsite equipment needed to keep microwave and other transmitters cool. The anticipated increase in wildland fires due to drought (USGCRP, 2014e) may also present a risk to both permanent and mobile installations as well as to first responders themselves.

16.2.14.5. 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 Utah, 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 Infrastructure, the following are likely to have no impacts to climate change under the conditions described below:

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions.
- Satellites and Other Technologies
    - Satellite Enabled Devices and Equipment: The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create any perceptible changes in GHG emissions because they would not create any new emissions sources.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

Potential to Have Impacts

The deployment and use of energy-consuming equipment as a result of the implementation of the Preferred Alternative would result in GHG emissions whose significance would vary depending on their power requirements, duration and intensity of use, and number. The types of infrastructure deployment scenarios that could be part of the Preferred Alternative and result in potential impacts to GHG emissions and climate change include the following:

- Wireless Projects
    - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
    - New Build Aerial Fiber Optic Plant: These projects could 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 engine 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, 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. Land use emissions occur as a result of soil disturbance and loss of vegetation. Impacts are anticipated to be less than significant due to the limited extent and temporary 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.

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 from the project, while adaptation refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause. 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'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.

16.2.14.6. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. Chapter 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.

Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant due to the limited extent and temporary nature of the deployment. 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. Impacts are anticipated to be less than significant due to the limited extent and temporary nature of the deployment.

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

Climate Change Impacts on FirstNet 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, and balloons 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 if the technologies are deployed within a short period of time (less than a decade). If there are no permanent structures, particularly near coastal areas, there would be little to no impacts as a result of sea-level rise. However, if these technologies are deployed continuously (at the required location) for a time period greater than a decade, climate change effects on infrastructure could be similar to the Proposed Action, 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 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 16.1.14, Climate Change.

16.2.15. Human Health and Safety

16.2.15.1. Introduction

This section describes potential impacts to human health and safety in Utah 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.

16.2.15.2. 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 16.2.15-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to human health and safety addressed in this section are presented as a range of possible impacts.

Table 16.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And Manmade Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

NA = Not Applicable

16.2.15.3. 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 16.2.15-1, occupational injury impacts could be potentially significant if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites. For example, if fuel is spilled from an onsite fuel tank, the spilled fuel could migrate down gradient and infiltrate underground drinking water sources. The general public may then be exposed to hazardous chemicals in their drinking water if they utilize the same groundwater aquifer.

To protect occupational workers, OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2015c).

1.) Engineering controls;

2.) Work practice controls;

3.) Administrative controls; and then

4.) Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, to areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes[152], 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

[152]Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents. (OSHA, 2016c)

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.

Occupational and public health is regulated by the Utah Department of Health (UTDOH) to oversee employee safety in public or private sector workplaces. Therefore, these agencies defer all regulatory authority and enforcement for occupational safety relating to FirstNet site work to the leadership and interpretation of OSHA. 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.

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 16.2.15-1, 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 UDEQ, 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, CERCLA, and applicable Utah 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, UDEQ 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. 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.

Natural and Manmade Disasters

FirstNet intends 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 impacting 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 affects 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 16.2.15-1, 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. 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.

16.2.15.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: the pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Some locations with no existing power supply may require the use of electrical generators. Hazardous materials needed for this work would include fiber optical cable lubricants, mechanical oil/grease, and fuel for electrical generators although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury or chemical exposure, or surface disturbances since work would be limited to existing entry and exit points, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to human health and safety because there would be no ground disturbance or heavy equipment used.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact human health and safety resources, it is anticipated that this activity would have no impact on those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain

environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines would require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in limited nearshore and inland bodies of water requires workers to operate over aquatic environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shore to accept submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of

heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive

maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the above mentioned FirstNet activities could potentially involve site preparation work, construction activities, work in dangerous environments (road ROW, work over water, historic environmental contamination, and mine lands), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of this infrastructure could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure to 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 above mentioned 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 measure 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.

16.2.15.5. 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 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 16.1.15, Human Health and Safety.

UT Appendix A – Biological Resources

Table A1: Key Terrestrial Habitats for Conservation in Utah

Community Type	USEPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
Lowland Riparian Habitat	Central Basin and Range; Colorado Plateau	Basin and Range; Colorado Plateau	Lowland riparian habitats are home to Fremont cottonwood (Populus fremontii), tamarisk (Tamarix spp.), netleaf hackberry (Celtis reticulate), velvet ash (Fraxinus velutina), desert willow (Chilopsis linearis) and squawbush (Rhus trilobata).	Covering less than 1 percent of Utah’s land area, lowland riparian habitat is scattered throughout the state with concentrations on either side of the Wasatch and Uinta Mountains.
Mountain Riparian Habitat	Wasatch and Uinta Mountains	Middle Rocky Mountains	Along Utah’s mountain streams are willow (Salix spp.), cottonwood (Populus spp.), water birch (Betula nigra), black hawthorn (Crataegus douglasii), and wild rose (Rosa spp.).	Covering less than 1 percent of Utah’s land area, located along Utah’s mountain streams.
Shrub Steppe	Entire State	Entire State	Sagebrush is the most common plant in shrub steppe habitats, including: big (Artemisia tridentata), black (Artemisia nova), low (Artemisia arbuscular), and silver sagebrush (Artemisia cana). Other plants in this habitat include: bluebunch wheatgrass (Pseudoroegneria spicata), needle grass (Stipa spp.), rabbit brush (Ericameria nauseosa), juniper, pinyon, and mountain mahogany (Cercocarpus spp.).	Shrub steppe habitats cover over 13 percent of Utah’s surface. However, this habitat type occurs throughout the state.
Mountain Shrub Habitat	Wasatch and Uinta Mountains	Middle Rocky Mountains	Smaller trees and shrubs dominate the mountain shrub habitat. Plants such as cliff rose (Purshia spp.), Utah serviceberry, chokecherry (Prunus virginiana), snowberry (Symphoricarpos spp.), and bigtooth maple (Acer grandidentatum) are common in mountain shrub habitats.	Covering approximately 1 percent of Utah’s land area, Mountain Shrub habitat occurs along the Wasatch and Uinta Mountains.
Wet Meadows	Wasatch and Uinta Mountains, Colorado Plateau	Middle Rocky Mountains	Wet meadows are home to sedges, rushes and reedgrasses.	Covering less than 1 percent of Utah’s land area, Wet Meadows are located along the Wasatch and Uinta Mountains and to a limited extent on the Colorado Plateau.
Grasslands	Entire State	Entire State	The most abundant plants in grasslands are grasses (Poa spp.), but wildflowers such as yarrow (Achillea millefolium) and Richardson’s geranium (Geranium richardsonii) also occur.	Grasslands cover approximately 3.5 percent of Utah’s land area, but are scattered throughout the state.
Aspen Forest	Wasatch and Uinta Mountains,	Middle Rocky Mountains	Aspen trees (Populus tremuloides) are the dominant trees in the aspen forest, but shrubs such as snowberry and wildflowers such as mountain bluebells	Covering just 3 percent of Utah's land area, aspen forest are located primarily

Community Type	USEPA Ecoregion(s)	Geographic Region(s)	Description	Distribution
	Colorado Plateau		(Mertensia ciliata) are often found on the forest floor.	along the Wasatch and Uinta Mountains.

Source: (UDWR 2005)

ACRONYMS

Acronym	Definition
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AERO	Utah Division of Aeronautics
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AIRFA	American Indian Religious Freedom Act
AML	Abandoned Mine Lands
APE	Area of Potential Effect
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act
ASL	Above Sea Level
ASPM	Aviation System Performance Metrics
ASTDR	Agency for Toxic Substances and Disease Registry
ATC	Air Traffic Control
ATO	Air Traffic Organization
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BOR	Bureau of Reclamation
CAA	Clean Air Act
CCD	Common Core of Data
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
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 Trucks
COW	Cell On Wheels
CRS	Community Rating System
CWA	Clean Water Act
CWS	Community Water Systems
DOD	Department of Defense
DOE	Department of Energy
DPS	Distinct Population Segment
EDACS	Enhanced Digital Access System
EFH	Essential Fish Habitat
EIA	Energy Information Agency
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 Regulations
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency

Acronym	Definition
FGDC	Federal Geographic Data Committee
FHWA	Federal Highways Administration
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act of 1976
FR	Federal Register
FRA	Federal Railway Administration
FTA	Federal Transit Authority
FSDO	Flight Standards District Offices
FSS	Flight Service Station
GAO	Government Accountability Office
GAP	Gap Analysis Program
GHG	Greenhouse Gas
GNIS	Geographic Names Information System
GSENM	Grand Staircase-Excalante National Monument
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IBA	International Birding Area
IBIS	Indicator Based Information System
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
LBS	Locations-Based Services
LCCS	Land Cover Classification System
LID	Low Impact Development
LMR	Land Mobile Radio
LRR	Land Resource Regions
LTE	Long Term Evolution
MBTA	Migratory Bird Treaty Act
MDI	Methylene Diphenyl Diisocyanate
MHI	Median Household Income
MLRA	Major Land Resource Areas
MOA	Memorandum of Agreement
MMT	Million Metric Tons
MSFCMA	Magnuson-Stevens Fisheries Conservation Management Act
MSL	Mean Sea Level
MT	Million Tons
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
NAICS	North American Industry Classification System
NAS	National Airspace System
NASAO	National Association of State Aviation Officials
NEPA	National Environmental Policy Act
NESCA	Nongame and Endangered Species Conservation Act
NFIP	National Flood Insurance Program
NGPC	Nebraska Game and Parks Commission
NHA	National Heritage Areas
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
NIH	National Institute of Health

Acronym	Definition
NIST	National Institute of Standards and Technology
NM	Nautical Miles
NNL	National Natural Landmarks
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notices To Airmen
NO_X	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	Nationwide Public Safety Broadband Network
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NTIA	National Telecommunications and Information Administration
NTFI	National Task Force On Interoperability
NTNC	Non-Transient Non-Community
NWI	National Wetlands Inventory
NWR	National Wildlife Refuges
NWS	National Weather Service
OCIO	Office of the CIO
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
ORION	Omaha Regional Interop Network
OSHA	Occupational Safety and Health Administration
OTR	Ozone Transport Region
PAB	Palustrine Aquatic Bed
PEIS	Programmatic Environmental Impact Statement
PEM	Palustrine Emergent Wetland
PFO	Palustrine Forested Wetland
PGA	Peak Ground Acceleration
PM	Particulate Matter
POP	Points of Presence
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSC	Public Service Commission
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PSS	Palustrine Scrub-Shrub Wetland
PUB	Palustrine Unconsolidated Bottom
R&D	Research and Development
RACOM	Radio Communications
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
ROW	Right-of-Way
SAA	Sense and Avoid
SASP	State Aviation System Plan
SCEC	State Climate Extremes Committee
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SF_6	Sulfur Hexafluoride
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office

Acronym	Definition
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_3	Sulfur Trioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SOW	System On Wheels
SO_X	Oxides of Sulfur
SPL	Sound Pressure Level
SRS	Statewide Radio System
SUA	Special Use Airspace
SWPPP	Storm Water Pollution Prevention Plan
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
TNC	Transient Non-Community Systems
TPY	Tons Per Year
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
UA	Unmanned Aircraft
UAMPS	Utah Associated Municipal Power Systems
UAS	Unmanned Aircraft Systems
UCA	Utah Communications Authority
UDEQ	Utah Department of Environmental Quality
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
UGS	Utah Geological Survey
UHF	Ultra High Frequency
UHP	Utah Highway Patrol
UMPA	Utah Municipal Power Agency
UOSH	Utah Occupational Safety and Health Division
UP	Union Pacific
UPDES	Utah Pollutant Discharge Elimination System
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
UT	Utah
UTA	Utah Transit Authority
UTDOH	Utah Department of Health
UTDPS	Utah Department of Public Safety
UNHP	Utah Natural Heritage Program
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compounds
WCS	Wetlands Classification Standard
WMA	Wildlife Management Areas
WMD	Wetland Management District

Acronym	**Definition**
WONDER	Wide-Ranging Online Data For Epidemiologic Research
WWI	World War I
WWII	World War II

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