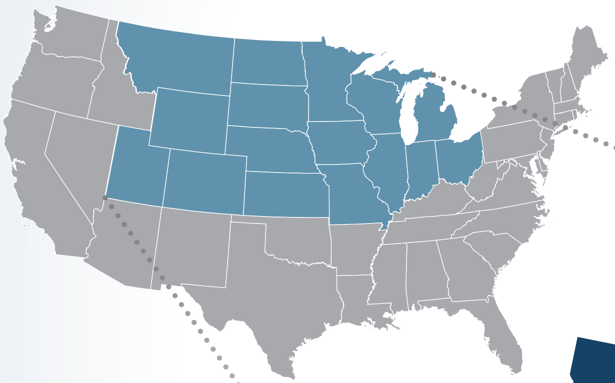
Nationwide Public Safety Broadband Network

Final Programmatic Environmental Impact Statement for the Central United States

VOLUME 4 - CHAPTER 6



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JUNE 2017

First Responder Network Authority

Nationwide Public Safety Broadband Network
Final Programmatic Environmental Impact Statement for the Central United States

VOLUME 4 - CHAPTER 6

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

Cooperating Agencies
Federal Communications Commission
General Services Administration
U.S. Department of Agriculture—Rural Utilities Service
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U.S. Department of Commerce—National Telecommunications and Information Administration
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June 2017

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6. IOWA

American Indian tribes with a rich cultural history lived in what is now the state of Iowa for centuries before the 1800s. The United States acquired Iowa in the early 1800s as part of the Louisiana Purchase, but it was closed to settlement until the early 1830s. Iowa became part of Michigan Territory, and then Wisconsin Territory, before finally becoming a state in 1846 (Iowa State University - Dorothy Schwieder, 2015). Iowa is bordered by Minnesota to the north, Wisconsin and Illinois to the east, South Dakota and Nebraska to the west, and Missouri to the south. This chapter provides details about the existing environment of Iowa as it relates to the Proposed Action.

General facts about Iowa are provided below:

- **State Nickname**: The Hawkeye State
- **Land Area:** 55,857 square miles; **U.S. Rank**: 26 (U.S. Census Bureau, 2015a)
- **Capital:** Des Moines
- **Counties:** 99 (U.S. Census Bureau, 2015c)
- **2014 Estimated Population:** Over 3.1 million people; **U.S. Rank:** 30 (U.S. Census Bureau, 2015b)
- **Most Populated Cities:** Des Moines and Cedar Rapids (U.S. Census Bureau, 2015c)
- **Main Rivers:** Missouri, Floyd, North Raccoon, Middle Nodaway, Des Moines, Cedar, Turkey, Iowa, Skunk, and Mississippi Rivers
- **Bordering Waterbodies:** Missouri River and Mississippi River
- **Mountain Ranges:** Loess Hills and Paleozoic Plateau
- **Highest Point:** Hawkeye Point (1,670 ft) (USGS, 2015a)

6.1. AFFECTED ENVIRONMENT

6.1.1. Infrastructure

6.1.1.1. Definition of the Resource

This section provides information on key Iowa infrastructure resources that could potentially be affected by FirstNet projects. Infrastructure consists of the systems and physical structures that enable a population in a specified area to function. Infrastructure is entirely manmade with a high correlation between the type and extent of infrastructure and the degree to which an area is characterized as "developed". Infrastructure includes a broad array of facilities such as utility systems, streets and highways, railroads, airports, buildings and structures, ports, harbors and other manmade facilities. Individuals, businesses, government entities, and virtually all relationships between these groups depend on infrastructure for their most basic needs, as well as for critical and advanced needs (e.g., emergency response, health care, and telecommunications).

Section 6.1.1.3 provides an overview of the traffic and transportation infrastructure in Iowa, including road and rail networks and airport facilities. Iowa 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 Iowa are presented in more detail in Section 6.1.1.4. Section 6.1.15 describes specific public safety communications infrastructure and commercial telecommunications infrastructure in Iowa. An overview of utilities in Iowa, such as power, water, and sewer, are presented in Section 6.1.1.6.

6.1.1.2. Specific Regulatory Considerations

Multiple Iowa laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 6.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state's applicable statutes and administrative rules referenced in column one. Section 1.8, Overview of Relevant Federal Laws and Executive Orders, and Appendix C, Environmental Laws and Regulations, identify applicable federal laws and regulations.

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

Table 6.1.1-1: Relevant Iowa Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Title III Public Services and Regulation, Rule 605 Homeland Security and Emergency Management Department	Iowa Department of Homeland Security and Emergency Management	Administers emergency planning matters; prepares a comprehensive emergency plan and emergency management program for homeland security; provides for the orderly development, installation, and operation of enhanced 911 emergency telephone systems
Title VIII Transportation, Rule 199 Utilities Division	Iowa Utilities Board	Regulates waterworks, sewage works, gas, electric, and telecommunications companies
Title VIII Transportation, Rule 761 Transportation Department	Iowa Department of Transportation	Plans, develops, regulates, and improves transportation in the state, including railways, aeronautics, and mass transit

Source: (Iowa Department of Homeland Security and Emergency Management, 2013), (Iowa Utilities Board, 2016), (Iowa Department of Transportation, 2015)

6.1.1.3. Transportation

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

The Iowa Department of Transportation (IDOT) 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 IDOT is to “deliver a modern transportation system that provides pathways for the social and economic vitality of Iowa, increases safety, and maximizes customer satisfaction” (IDOT, 2015a).

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

- 114,429 miles of public roads (FHWA, 2014) and 24,300 bridges (FHWA, 2015a);
- 3,947 miles of rail network that includes passenger rail and freight (IDOT, 2009);
- 291 aviation facilities, including airstrips and heliports (FAA, 2015a); and
- No harbors or ports.

Road Networks

As identified in Figure 6.1.1-1, the major urban centers of the state from north to south are Sioux City, Waterloo, Dubuque, Cedar Rapids, Davenport, Iowa City, Des Moines, and Burlington. Iowa 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 interstate, state and county roads. Table 6.1.1-2 lists the interstates and their start/end points in Iowa. 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 6.1.1-2: Iowa Interstates

Interstate	Southern or western terminus in IA	Northern or eastern terminus in IA
I-29	MO line in Hamburg	SD line in Sioux City
I-35	MO line in Fayette	MN line in Hartland
I-74	I-80 in Davenport	IL line in Bettendorf
I-80	NE line in Council Bluffs	IL line in LeClaire

Source:(FHWA, 2015b)

In addition to the Interstate System, Iowa has both National Scenic Byways and State Scenic Byways. National and State Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities (FHWA, 2013). Figure 6.1.1-1 illustrates the major transportation networks, including roadways, in Iowa. Section 6.1.8, Visual Resources, describes the National and State Scenic Byways found in Iowa from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the byways are designated and managed by the U.S. Department of Transportation's Federal Highway Administration. Iowa has two National Scenic Byways: the Great River Road and Loess Hills Scenic Byway (FHWA, 2015c). State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by IDOT. Some State Scenic Byways may be designated on portions of National Scenic Byways. Iowa has nine State Scenic Byways that crisscross the entire state[2] (IDOT, 2015b):

- Delaware Crossing Scenic Byway
- Driftless Area Scenic Byway
- Glacial Trail Scenic Byway
- Grant Wood Scenic Byway
- Historic Hills Scenic Byway
- Iowa Valley Scenic Byway
- Lincoln Highway Heritage Byway
- River Bluffs Scenic Byway
- Western Skies Scenic Byway

Airports

Air service to the state is provided by Des Moines International Airport (DSM). DSM is operated by the Des Moines Airport Authority Board (DSM, 2015). In 2014, the airport served 2.3 million passengers and handled over 130 million pounds of cargo (DSM, 2014). In Iowa, DSM and the Eastern Iowa Airport (CID) have combined annual operations of more than 119,000 flights (FAA, 2015b). Figure 6.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 6.1.7, Land Use, Recreation, and Airspace, provides greater detail on airports and airspace in Iowa.

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

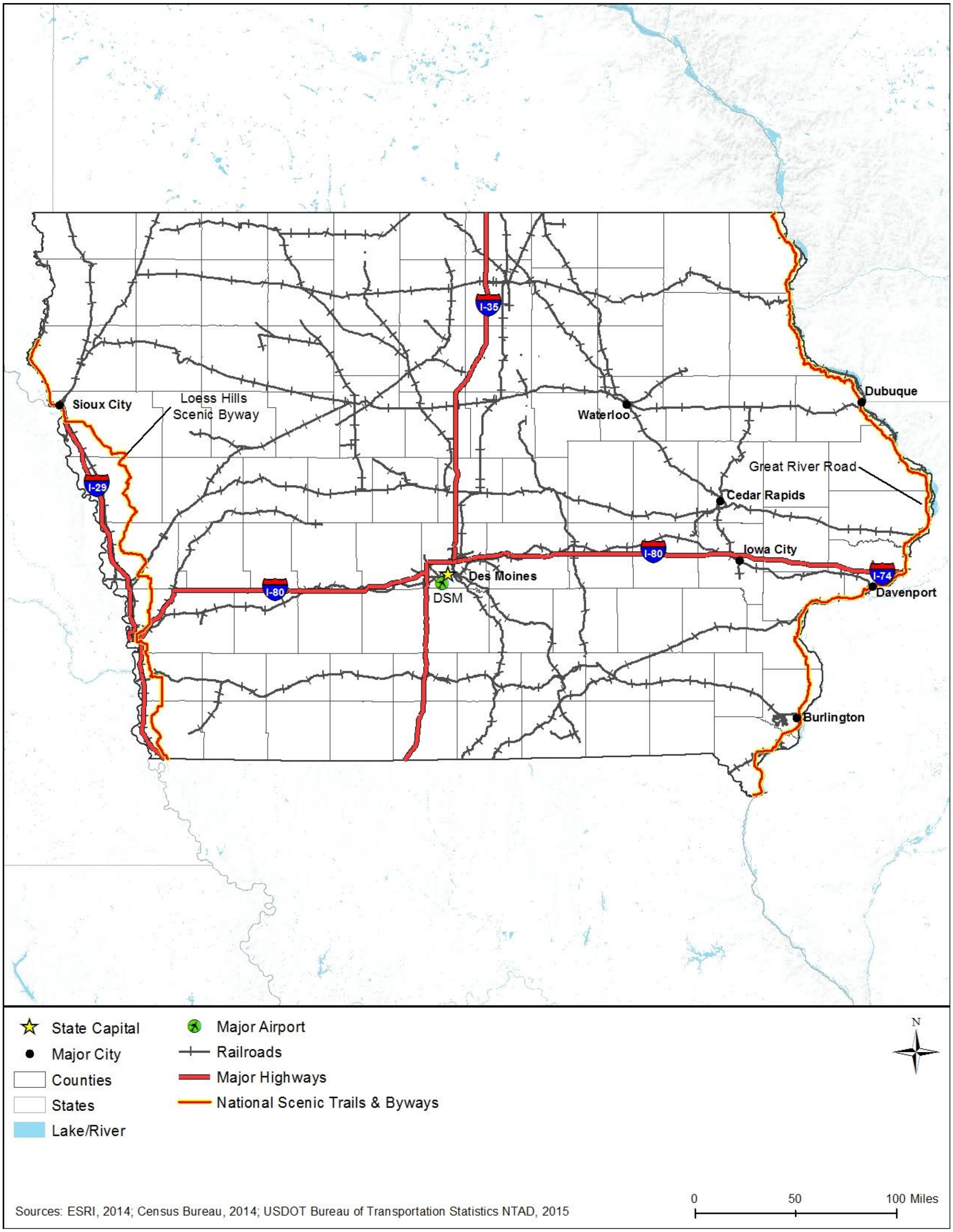


Figure 6.1.1-1: Iowa Transportation Networks

Rail Networks

Iowa is connected to a network of passenger rail (Amtrak) and freight rail. Figure 6.1.1-1 illustrates the major transportation networks, including rail lines, in Iowa. 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.

Amtrak runs two lines through Iowa: the California Zephyr and the Southwest Chief. The California Zephyr runs from Chicago to San Francisco every day; the southwest Chief travels between Chicago and Los Angeles once per day (Amtrak, 2015). Amtrak serves 50,000 to 60,000 passengers per year in Iowa: 16 percent of passengers on the California Zephyr either embark or disembark in Iowa and 3 percent of passengers on the Southwest Chief utilize Iowa stations (IDOT, 2009). Table 6.1.1-3 provides a complete list of Amtrak lines that run through Iowa.

Table 6.1.1-3: Amtrak Train Routes Serving Iowa

Route	Starting Point	Ending Point	Length of Trip	Cities Served in Iowa
California Zephyr	Chicago, IL	Emeryville, CA	51 hours 20 minutes	Burlington, Mt. Pleasant, Ottumwa, Osceola, Creston
Southwest Chief	Chicago, IL	Los Angeles, CA	40+ hours	Fort Madison

Source: (Amtrak, 2015)

Freight rail plays an important role in Iowa because of the state's agricultural economic base: "farmers save up to 10 cents per bushel by using the railroad system" (IDOT, 2009). Out of Iowa's 99 counties, 90 are served by freight rail (IDOT, 2009). The Federal Railroad Administration (FRA) classifies railroads as Class I, Class II, or Class III based on corporate revenue thresholds (FRA, 2015a). As of 2008, rail companies operating in Iowa include 5 Class I freight rail companies (2,605 miles of track in the state), 3 Class II railroads (985 miles of track), and 12 Class III railroads (318 miles of track) (IDOT, 2009). While most freight rail traffic passes through the state, the commodities that originate in Iowa and travel via freight rail to destinations outside the state are primarily farm and food products (IDOT, 2009).

Harbors and Ports

Iowa's eastern border is the Mississippi River, which is a major U.S. waterway that provides commercial cargo transportation, and recreational boating operations, including fishing, sightseeing, and riverboat cruises. Most commercial vessels transiting Iowa waters and using its waterway infrastructure are hauling agricultural commodities, petroleum products, or steel (USDA, 2010). The U.S. Army Corps of Engineers operates 11 Mississippi River locks and dams in Iowa (crossing to Illinois or Wisconsin). There are two major ports in the state: the Port of Burlington and the Port of Keokuk (USFWS, 2006).

The Port of Burlington has several large grain elevators and adjunct dock infrastructure. The North Elevator Dock has a grain elevator with capacity for 450,000 bushels, 400-feet of berthing space, and is served by the Burlington Junction Railroad. The South Elevator Dock has a grain elevator with capacity for 550,000 bushels, 400 feet berthing space, and is served by the Burlington Northern Santa Fe Railway. The Gulfport Elevator Dock has a capacity for 300,000 bushels and 500-feet berthing space. The port's 200-foot Generating Station Wharf has capacity for 100,000 tons of coal and is connected to the Burlington Northern Santa Fe Railway. The 200-foot River Terminal North Dock ships and receives steel products, liquid and dry bulk fertilizers, and containerized general cargo, and ships gypsum rock and coal. Matteson Marine Service operates a fleet of barges and other floating equipment from the 100-foot South Dock (World Port Source, 2016a).

The Port of Keokuk receives and ships steel products, dry bulk materials, and unitized and heavy-lift general cargo, as well as grain and lumber, and bulk cargos of fertilizer, salt, coal, pig iron, scrap metal, and stone. This Port of Keokuk Dock also receives grain and lumber. The port is served by the Burlington Northern Santa Fe Railway and the Keokuk Junction Railway. The port's Iowa Gateway Terminal Dock is 400 feet, and adjunct infrastructure can store 50,000 tons of coal and other dry bulk commodities, and has a 4-acre open storage area for steel products. The Iowa Gateway Terminal Dock also has a 33,000 square foot food-grade storage warehouse and a towboat, which serve 100-barge fleet on the Des Moines River. The 155-feet Roquette America River Terminal Dock ships livestock feed and grains, and has 800,000 bushel on-site storage capacity. The Port of Keokuk is the homeport to the U.S. Coast Guard Cutter *Scioto* (WLR-65504), as well as the museum ship Str. George M. Verity, a historic steam-powered towboat and National Historic Landmark (World Port Source, 2016b).

Also on the Mississippi River in Iowa is the Port of Dubuque, a small port for recreational craft. The 70-slip transient marina is in downtown Dubuque at Mile 579.4 of the Upper Mississippi River. Fuel and sanitary services are available, as well as provisioning. Adjacent recreational venues are the National Mississippi River Museum and Aquarium, the Grand Harbor Resort and Waterpark, the Diamond Jo Casino, and Stone Cliff Winery (City of Dubuque, 2016).

6.1.1.4. Public Safety Services

Iowa public safety services generally consist of public safety infrastructure and first responder personnel aligned with the demographics of the state. Table 6.1.1-4 presents Iowa's key demographics including estimated population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 6.1.9, Socioeconomics.

Table 6.1.1-4: Key Iowa Indicators

Iowa Indicators	
Estimated Population (2014)	3,107,126
Land Area (square miles) (2010)	55,857
Population Density (persons per sq. mile) (2010)	54
Municipal Governments (2013)	1,046

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

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

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

Infrastructure Type	Number
Fire and Rescue Stations[a]	812
Law Enforcement Agencies[b]	392
Fire Departments[c]	731

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 6.1.1-6: First Responder Personnel in Iowa by Type

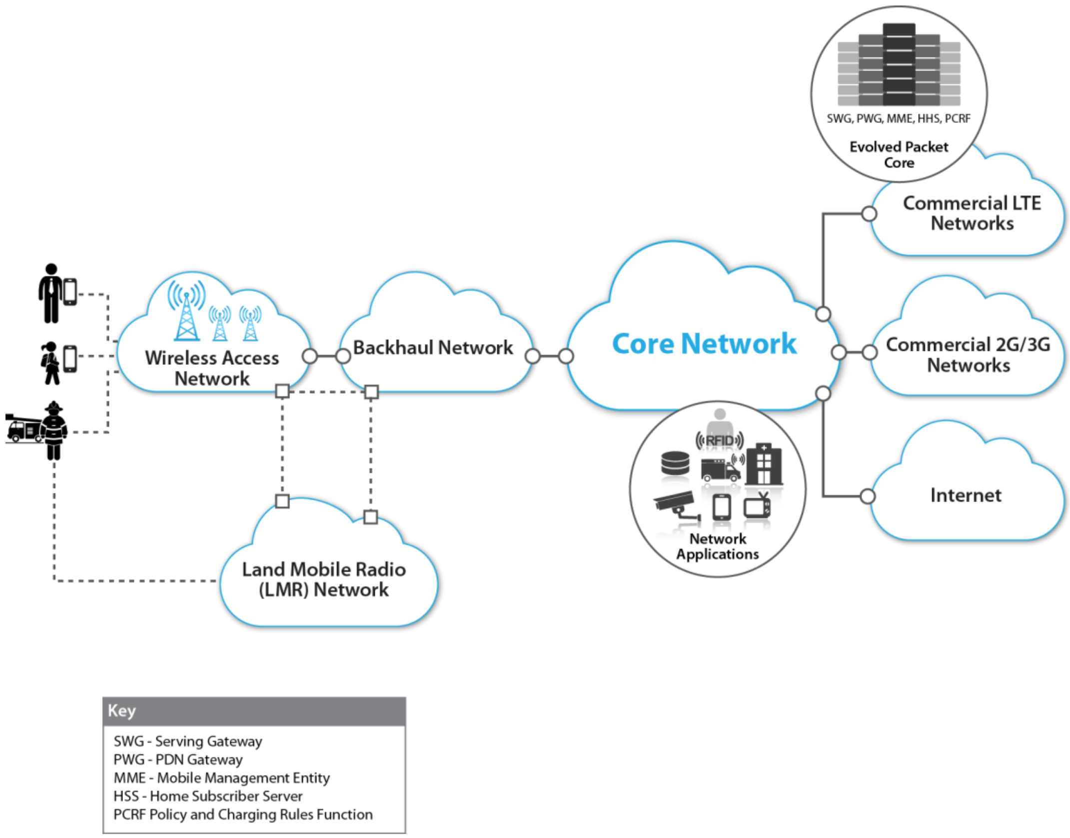
First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers[a]	1,070
Fire and Rescue Personnel[b]	16,725
Law Enforcement Personnel[c]	8,896
Emergency Medical Technicians and Paramedics[d, e]	2,390

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

[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.

6.1.1.5. 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 6.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including a long term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications.



Prepared by: Booz Allen Hamilton

Figure 6.1.1-2: 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 6.1.1), 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. Chief among these factors impacting information sharing are: network coverage gaps, land mobile radio system infrastructure diversity, insufficient budgets, and diverse radio frequencies.

Communication interoperability has also been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the U.S. and specifically in Iowa. 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 networks with a nationwide public safety LTE broadband network, the U.S. Department of Commerce Public Safety Communications Research Program (PSCR) prepared a locations-based services (LBS) research and development roadmap to examine the current state of location-based technologies, forecast the evolution of LBS capabilities and gaps, and identify potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years to better inform investment decisions (PSCR, 2015).

Iowa's public safety LMR network environment is in transition, reflects frequency diversity, and is similar to the networks found in most other states. The state has worked to improve the interoperability of its network through upgrades to its analog legacy systems as well as through the adoption of digital technologies such as Project 25 (P25) networks. The majority of Iowa's LMR radios depend on very high frequency (VHF)[3] frequencies as the state's SCIP explains, "Iowa's interoperable and emergency communications environment consists mainly (75 percent) of disparate VHF systems, some (approximately 15 percent) 800 MHz systems, and a small number of ultra-high frequency (UHF)[4] systems. While numerous state agencies use emergency communications systems, Iowa currently does not have a statewide public safety radio system or network due to lack of funding and the need for greater legislative support. Regional, state, and local agencies' radio communications systems consist primarily of separate systems" (State of Iowa, 2013).

In December 2012, the state issued a Request for Proposal (RFP) for a P25 Statewide LMR network, the Iowa Statewide Interoperable Communications System, detailing its requirements as follows: "The system is referred to as the Iowa Statewide Interoperable Communication System ("System"). The System must support mission critical communications within the state and with neighboring states (Minnesota, Wisconsin, Illinois, Missouri, Nebraska, and South Dakota). The System must be 700/800MHz APCO P25 Phase 2 compliant, highly reliable, fault tolerant, spectrally efficient, and easily scalable in order to meet the operational requirements for public safety first responders. The system must provide enhanced, two-way wireless

[3] VHF band covers frequencies ranging from 30 MHz to 300 MHz (NTIA, 2005).
[4] UHF band covers frequencies ranging from 300 MHz to 3000 MHz (NTIA, 2005).

communications capabilities to all users and be capable of interoperable communications…" (Iowa Dept. of Administrative Services (DAS), 2012).

The Iowa Statewide Interoperable Communications Systems Board (ISICSB) and the E-911 Communications Council play critical roles in public safety communications governance and planning. The ISICSB "is responsible for improving interoperability in Iowa by creating, implementing, training, and operating a statewide interoperable communications system. The ISICSB was legislatively created and signed into law in 2007…The E-911 Communications Council focuses on 911-related efforts in the state and works closely with the ISICSB to ensure a shared emergency communications vision and mission between the two groups is realized in Iowa" (State of Iowa, 2013).

In 2010, the Iowa Communications Network (ICN) was awarded a National Telecommunications Information Agency (NTIA) federal infrastructure grant to upgrade ISN's 3,000-fiber network (which spans the 99 Iowa counties). The project's overarching focus was to improve connectivity, coverage, and network capabilities to underserved communities. One of the chief objectives of the grant was to enable faster, more reliable connections to public safety locations in the state with 343 connections made in Iowa (ICN, 2013).

Statewide/Multi-County Public Safety Networks

The Iowa State Patrol (ISP), a unit within the Iowa Department of Public Safety (DPS), uses VHF as well as UHF frequencies across a wide range of applications, from tactical communications, to mutual aid, and to interagency communications (RadioReference.com, 2015a). The State Fire Marshall's Office, Criminal Investigations unit, and Commercial Vehicle enforcement all within the IOWA DPS all use DPS-assigned VHF/UHF frequencies (RadioReference.com, 2015a)

Like other states, Iowa leverages the nationwide frequencies (VHF, UHF, and 800 MHz) interoperability channels, and in addition, for law enforcement emergency communications, has access to the state VHF channel, Iowa Channel (RadioReference.com, 2015b). Iowa's adoption of P25 systems[5] has been evolving over time and as of mid-2015, five multi-county systems (three of which are multi-state as well, were operational in Iowa. These are summarized in Table 6.1.1-7 (RadioReference.com, 2015c).

City and County Public Safety Networks

As discussed previously, Iowa's public safety LMR environment is highly diverse in terms of frequency use and network technology utilization. In addition, the number and types of networks adopted by public safety agencies differs in the state based on community type (metro area versus rural community). Polk County, the location of Des Moines (with a population density of 658 persons per square mile), and Taylor County in southern Iowa (with a population density of 13 persons per square mile) exemplify this contrasting LMR situation in the state (U.S. Census Bureau, 2010).

[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.

Table 6.1.1-7: Iowa Multi-County/Multi-State P25 Systems

Iowa P25 Systems	Frequency Band	County Type
Central Iowa Communications System (CIRPSCS)	700 MHz	Multi-county (Polk and Marshall Counties)
Linn and Johnson County Public Safety	800 MHz	Multi-county
Omaha Region Interoperability Network (Orion)	800 MHz	Multi-county/Multi-state (Iowa [Pottawattamie County]/Nebraska [multiple counties])
Siouxland Tri-State Area Radio (STARCOMM)	800 MHz	Multi-county (Iowa [Woodbury County])/Multi-state (Iowa/Nebraska/South Dakota)
WestCom System	800 MHz	Multi-county (Polk, Dallas, and Warren Counties)

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

Public Safety Answering Points (PSAPs)

According to the Federal Communication Commission's (FCC) Master PSAP registry, there are 131 PSAPs in Iowa serving 99 counties (FCC, 2015a).

Commercial Telecommunications Infrastructure

Iowa'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 Iowa'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

Iowa's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems. Table 6.1.1-8 presents the number of providers of switched access[6] lines, Internet access,[7] and mobile wireless services including coverage.

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

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

Table 6.1.1-8: Telecommunications Access Providers and Coverage (2013)

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access line[a]	243	98% of households
Internet access[b]	185	52% of households
Mobile Wireless[c]	9	90% of population

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

[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 6.1.1.5, Last Mile Fiber Assets.

Table 6.1.1-9 shows the wireless providers in Iowa along with their geographic coverage. The following five maps: Figure 6.1.1-3 to Figure 6.1.1-7 show Verizon Wireless' and AT&T Mobility LLC's coverage; Sprint's and U.S. Cellular's coverage; Evertek Inc.'s and JAB Broadband's coverage; Chat Mobility's, SpeedConnect's, and Northwest Communication Inc.'s coverage; and the coverage of all other providers with less than 5 percent coverage area, respectively.[8]

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

Table 6.1.1-9: Wireless Telecommunications Coverage by Providers in Iowa

Wireless Telecommunications Providers	Coverage
Verizon Wireless	93.38%
U.S. Cellular	92.00%
AT&T Mobility LLC	84.68%
Sprint	35.50%
JAB Broadband	29.35%
Evertek, Inc.	10.43%
Chat Mobility	10.20%
SpeedConnect	10.11%
Northwest Communications, Inc.	5.42%
Other[a]	46.32%

Source: (NTIA, 2014)

[a]Other: Provider with less than 5% coverage area. Providers include: Woolstock Mutual Telephone; T-Mobile; NEIT; Webb Wireless, LLC; Loganet; Community Digital Wireless; Bernard Telephone; Farmers & Merchants Mutual Telephone; Starnet; ICS Advanced Technologies; Community Internet Services; Heartland Net; OmniTel Communications; Cloudburst 9, LLC; Sioux Valley Wireless; BissoWireless; The Community Agency (TCA); Mahaska Communication Group, LLC; RuralWaves; BTWI; Siouxland Wireless LLC; Louisa Communications; Grand Mound Cooperative Telephone Association; Be Line Wireless; TMU; Corn Belt Telephone Company; STC; Guthrie Center Communications; Natel; BitWind Communications; Iowa Connect, Inc.; IGL TeleConnect; ConnectPoint; Grundy Center Municipal Utilities; Massena Telephone Company; Panora Telco; Heart of Iowa Communications Cooperative; CS Technologies; Cricket Wireless; Osage Municipal Utilities; Spiral Communications; LTD Broadband LLC; MachLink; FiberComm; Prairieburg Telephone Company, Inc.; Cooperative Telephone Company; Farmers Mutual Cooperative Telephone Company; Mechanicsville Telephone Company; Tyson Communications; IAMO Wireless; Minburn Communications; Ayrshire Communications; Cedar Falls Municipal Communications Utility; South Central Communications, Inc.; Western Iowa Networks; MidIowa Net; AcenTek; Marne & Elk Horn Telephone Company; PowerNet; Wellman Cooperative Telephone Association; La Motte Telephone Company, Inc.; Harmony Telephone Company; Walnut Communications; MMCTSU

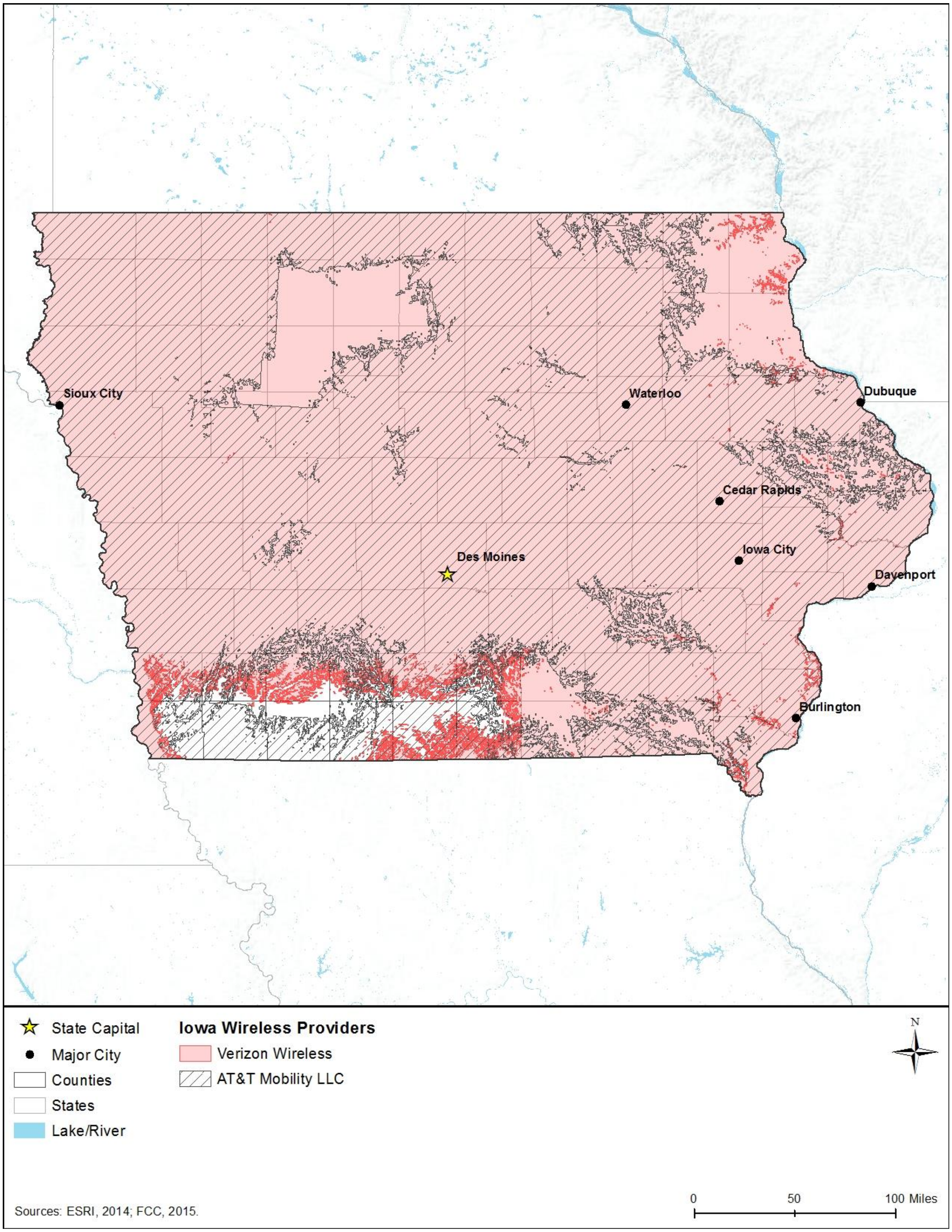


Figure 6.1.1-3: Top Wireless Providers Availability in Iowa

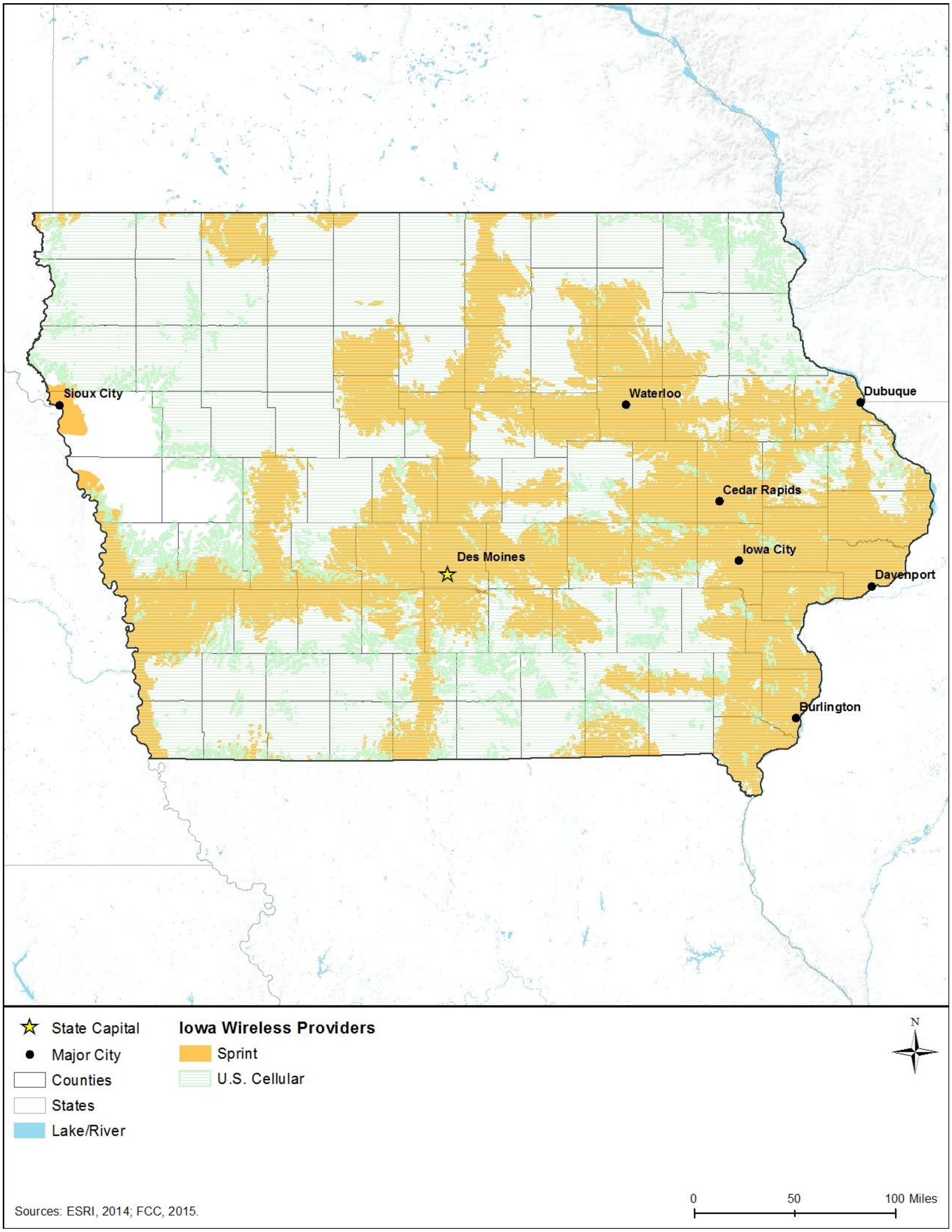


Figure 6.1.1-4: Sprint and U.S. Cellular Wireless Availability in Iowa

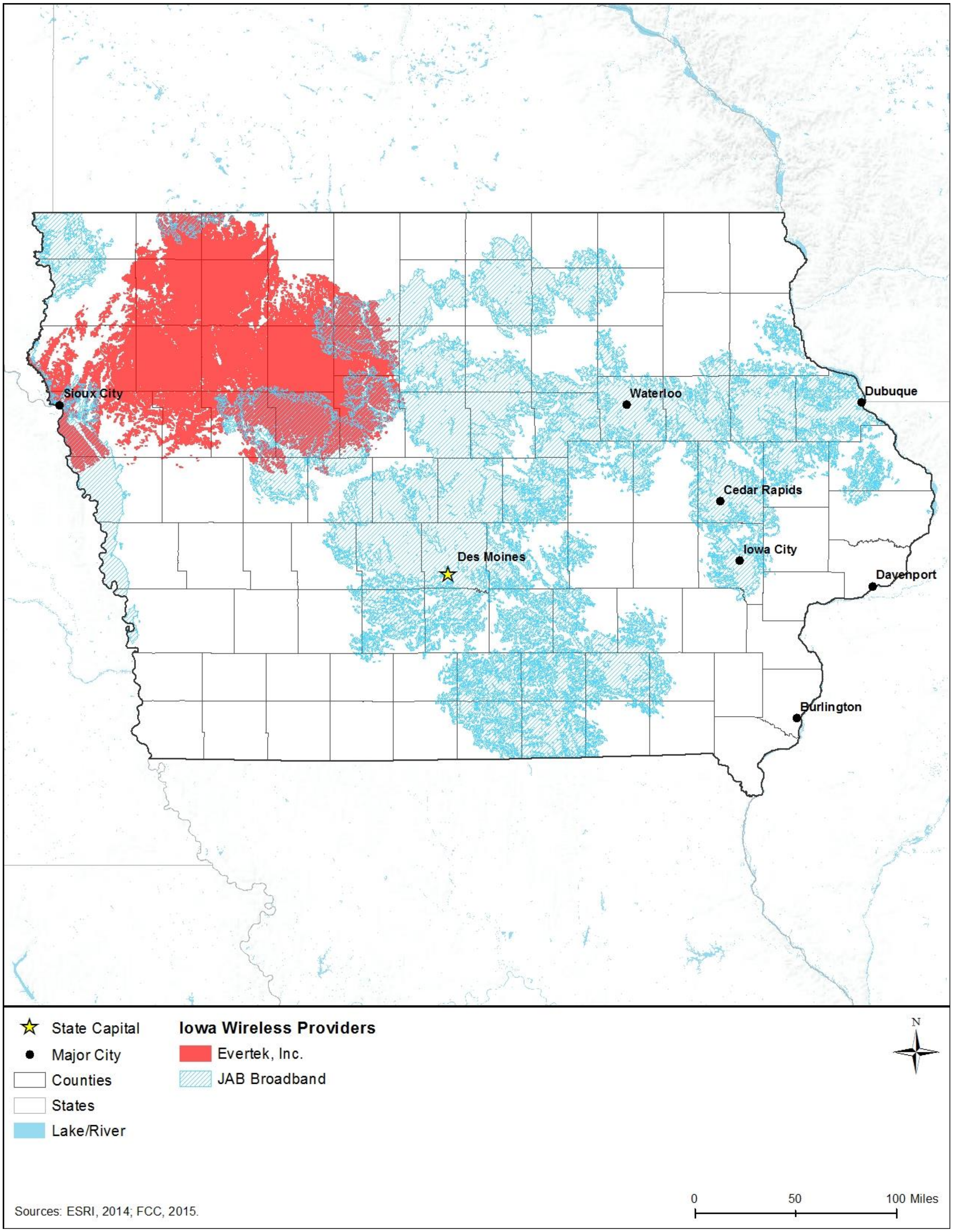


Figure 6.1.1-5: Evertek Inc. and JAB Broadband Wireless Availability in Iowa

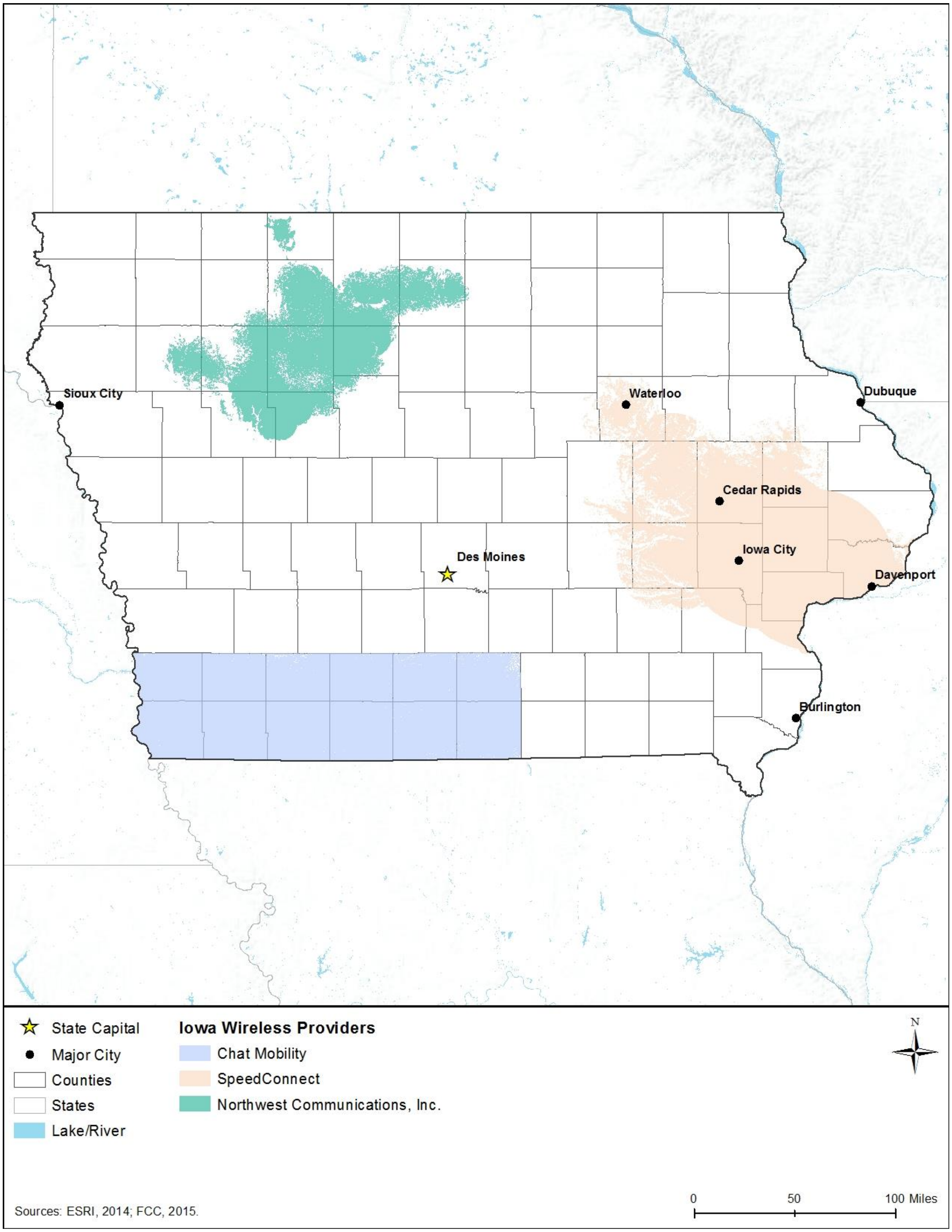


Figure 6.1.1-6: Chat Mobility, SpeedConnect, and Northwest Communications Inc. Wireless Availability in Iowa

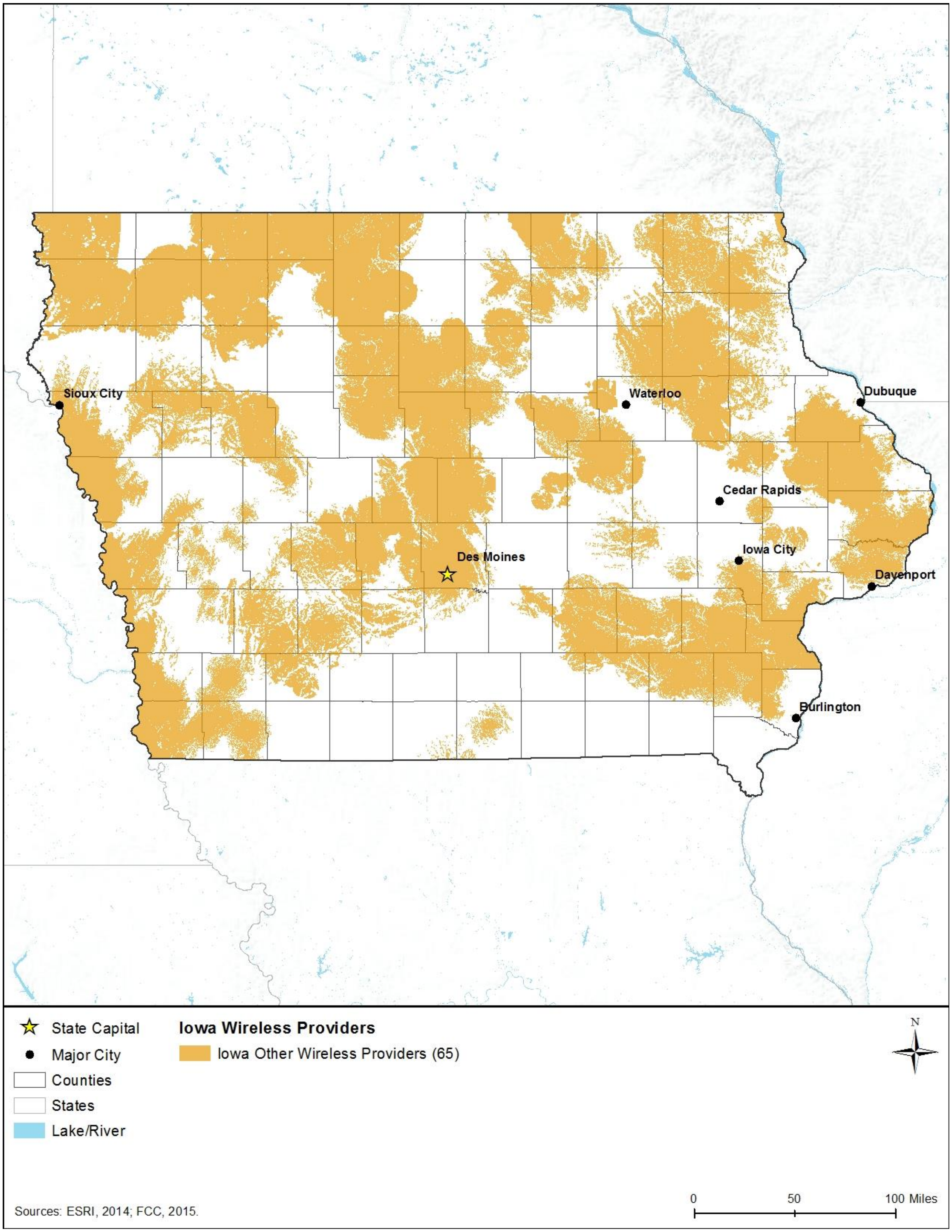


Figure 6.1.1-7: Other Providers Wireless Availability in Iowa

Towers

There are many types of domestic towers employed today by the telecommunications industry, government agencies, and other owners. Towers are designed and used for a variety of purposes, and the height, location, and supporting structures and equipment are all designed, constructed, and operated according to the technical specifications of the spectrum used, the type of equipment mounted on the tower, geographic terrain, need for line-of-sight transmissions to other towers, radio frequency needs, and other technical specifications. There are three general categories of stand-alone towers: monopole, lattice, and guyed. Typically, monopole towers are the smallest, followed by lattice towers at a moderate height, and guyed towers at taller heights (with the guyed wires providing tension support for the taller heights) (CSC, 2007). In general, taller towers can provide communications coverage over larger geographic areas, but require more land for the actual tower site, whereas shorter towers provide less geographic coverage and require less land for the tower site (USFS, 2009a). Figure 6.1.1-8 presents representative examples of each of these categories or types of towers.

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

Lattice
200 – 400 feet
Source: Personal Picture

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

Figure 6.1.1-8: Types of Towers

Telecommunications tower infrastructure proliferates throughout Iowa, although tower infrastructure is concentrated in the higher and more densely populated areas of Iowa; Sioux City, Waterloo, Dubuque, Cedar Rapids, Iowa City, Des Moines, and Burlington. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC (FCC, 2016a).[9] Table 6.1.1-10 presents the number of towers (including broadcast towers) registered with the FCC in Iowa, by tower type, and Figure 6.1.1-9 presents the location of those structures, as of June 2016.

Table 6.1.1-10: Number of Commercial Towers in Iowa by Type

Constructed[a] Towers[b]		Constructed Monopole Towers	
100ft and over	405	100ft and over	0
75ft – 100ft	649	75ft – 100ft	1
50ft – 75ft	573	50ft – 75ft	21
25ft – 50ft	265	25ft – 50ft	30
25ft and below	63	25ft and below	5
Subtotal	**1,955**	**Subtotal**	**57**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	52	100ft and over	2
75ft – 100ft	58	75ft – 100ft	5
50ft – 75ft	20	50ft – 75ft	0
25ft – 50ft	0	25ft – 50ft	4
25ft and below	1	25ft and below	2
Subtotal	**131**	**Subtotal**	**13**
Constructed Lattice Towers		**Multiple Constructed Structures [c]**	
100ft and over	6	100ft and over	1
75ft – 100ft	55	75ft – 100ft	1
50ft – 75ft	44	50ft – 75ft	0
25ft – 50ft	9	25ft – 50ft	1
25ft and below	2	25ft and below	0
Subtotal	**116**	**Subtotal**	**3**
Constructed Tanks [d]			
Tanks	18		
Subtotal	**18**		
Total All Tower Structures		**2,293**	

Source: (FCC, 2015b)

[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).

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

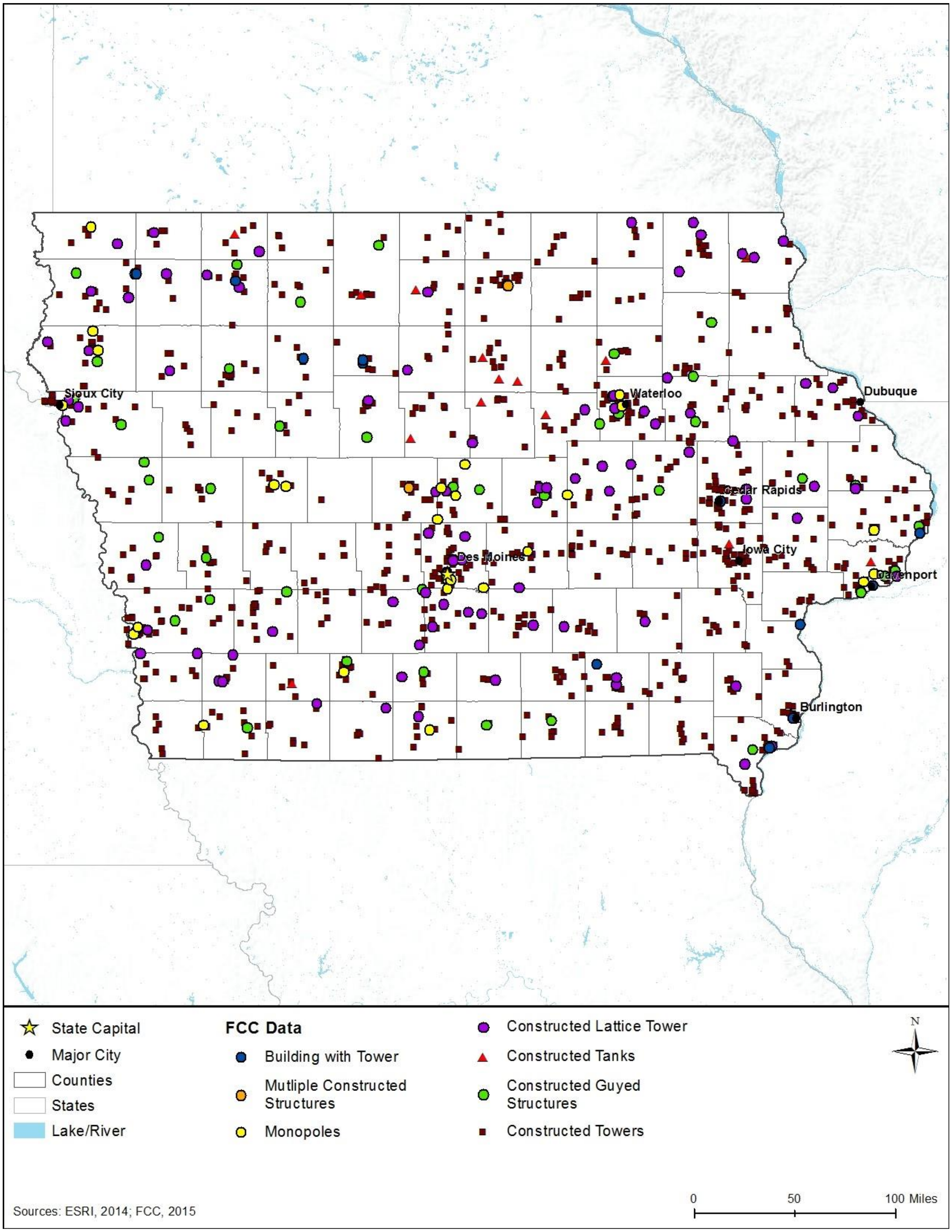
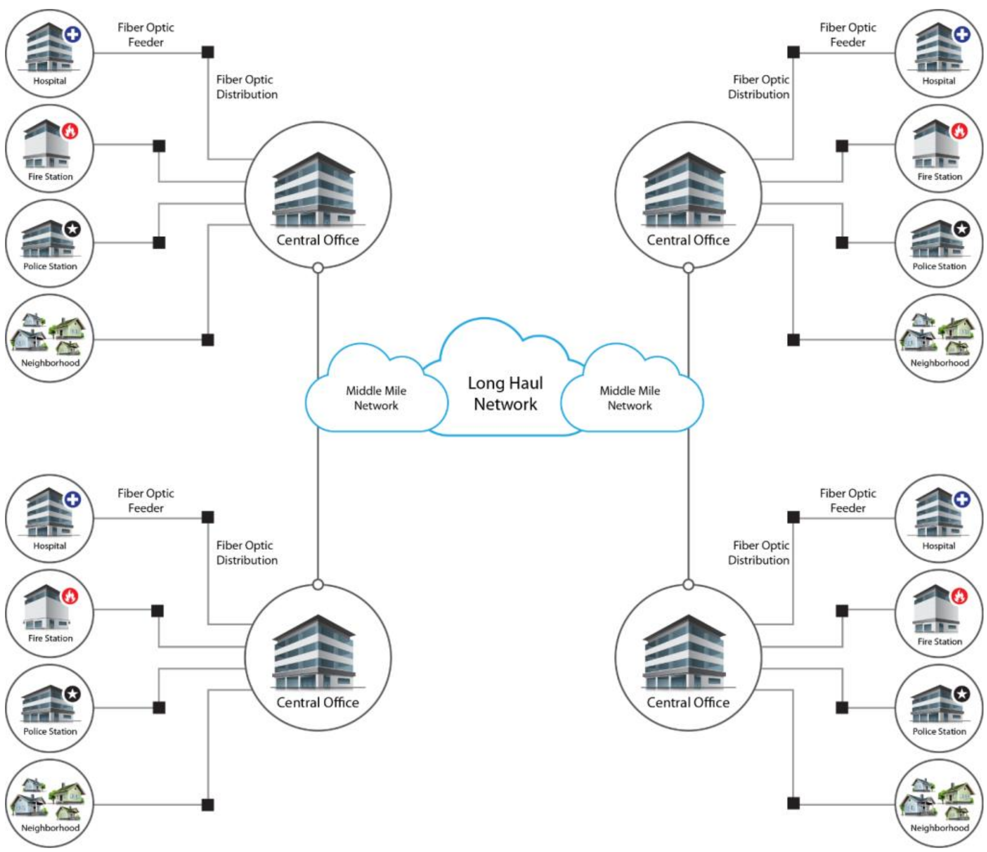


Figure 6.1.1-9: FCC Tower Structure Locations in Iowa

Fiber Optic Plant (Cables)

Fiber optic plant, or cables, can be buried directly in the ground; pulled, blown, or floated into ducts, conduits, or innerduct (flexible plastic protective sleeves or tubes); placed under water; or installed aerially between poles, typically on utility rights-of-way. A fiber optic network includes an access network consisting of a central office, distribution and feeder plant (cables of various sizes directly leaving a central office and splitting to connect users to the network), and a user location, as shown in Figure 6.1.1-10. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC, 2000).



Source: (ITU-T, 2012)
Prepared by: Booz Allen Hamilton

Figure 6.1.1-10: Typical Fiber Optic Network in Iowa

Last Mile Fiber Assets

In Iowa, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Iowa, there are 186 fiber providers that offer service in the state, as listed in Table 6.1.1-11 (NTIA, 2014). Figure 6.1.1-11 presents coverage for Windstream Iowa Communications, Inc., Mediacom, and CenturyLink. Figure 6.1.1-12 presents the coverage for other providers with less than 5 percent coverage area, respectively.

Table 6.1.1-11: Fiber Provider Coverage

Fiber Provider	Coverage
Windstream Iowa Communications, Inc.	13.34%
Mediacom	6.55%
CenturyLink	6.52%
Other[a]	46.90%

Source: (NTIA, 2014)

[a] Other: Provider with less than 5% coverage area. Providers include: Frontier Communications of Iowa; JAB Broadband; Winnebago Cooperative Telecom Association; GRM Networks; Webster-Calhoun Cooperative Telephone Association; Premier Communications; OmniTel Communications; Heart of Iowa Communications Cooperative; WesTel Systems; Western Iowa Networks; South Slope Cooperative Communications; AcenTek; Northwest Telephone Cooperative Association; Western Iowa Telephone; Farmers Mutual Cooperative Telephone Company; HickoryTech; Citizens Mutual Telephone Cooperative; Alpine Long Distance; Partner Communications Cooperative; NexGen Communications; Butler-Bremer Communications; Schaller Telephone Company; SCC Networks; Long Lines; Communications 1 Network; Van Buren Telephone Company; Ayrshire Farmers Mutual Telephone Company; Rockwell Coop Telephone Association; LISCO; Hills Telephone Company; F&B Communications; Griswold Cooperative Telephone Company; Lehigh Valley Cooperative Telephone Association; River Valley Telecommunications Coop; Farmers Mutual Telephone; Marne & Elk Horn Telephone Company; Coon Valley Cooperative Telephone; Liberty Communications; RingTel Communications; MCTC; East Buchanan Telephone Cooperative; Villisca Farmers Telephone Company; Cooperative Telephone Company; La Porte City Telephone Company; Jefferson Telephone Company; HTC Communications; C-M-L Telephone Cooperative Association; Farmers Mutual Telephone Cooperative; MTC Technologies; Mabel Cooperative Telephone Company; FCTC; Keystone Communications; Clear Lake Independent Telephone Company; Ogden Telephone Company; Walnut Communications; Sac County Mutual Telephone Company; Titonka Burt Communications; Southwest Telephone Exchange; Reasnor Telephone Company; Central Scott Telephone Company; Dumont Telephone Company; Interstate Communications; Minerva Valley Telephone Company; Cooperative Telephone Exchange; NEIT; Lost Nation-Elwood Telephone Company; Cedar Falls Municipal Communications Utility; Cascade Communications Company; Wellman Cooperative Telephone Association; Preston Telephone Company; Farmers Mutual Telephone; Ellsworth Cooperative Telephone Association; Hubbard Co-op Telephone Association; NU-Telecom; Brooklyn Mutual Telecommunications Cooperative; Farmers Mutual Cooperative Telephone Company of Moulton; Olin Telephone Company; Corn Belt Telephone Company; IAMO Telephone Company; Massena Telephone Company; Lone Rock Cooperative Telephone Company; Huxley Communications Cooperative; Miles Cooperative Telephone Association; United Farmers Telephone; Palmer Mutual Telephone Company; STC; Scranton Telephone Company; Mechanicsville Telephone Company; Royal Telephone Company; La Motte Telephone Company; Clarence Telephone Company; Goldfield Access Network; Casey Mutual Telephone Company; Bernard Telephone; Terril Telephone Cooperative; Stratford Mutual Telephone Company; Panora Telco; Martelle Communications Co-op; Dixon Telephone Company; Danville Telecom; Minburn Communications; Sully Telephone Association; Farmers & Merchants Mutual Telephone; Colo Telephone Company; North English Cooperative Telephone Company; Radcliffe Telephone Company; Readlyn Telephone Company; WesTel Systems; Fenton Co-Op Telephone Company; Kalona Cooperative Telephone Company; Coon Creek Telecommunications; CTC; Wyoming Mutual Telephone Company; Mutual Telephone; Dunkerton Telephone Cooperative; Minburn Communications; Farmer's Telephone Company of Batavia; Templeton Telephone Company; Hawkeye Telephone Company; Cable ONE; Springville Cooperative Telephone Association; Van Horne Cooperative Telephone Company; WTC Communications; Atkins Telephone Company; ATC Communications; FiberComm; Oran Mutual Telephone Company; MachLink; MidIowa Net; BEVCOMM; Arcadia Telephone Cooperative; Superior Telephone Cooperative; Cox Communications; Baldwin Nashville Telephone Company; Prairieburg Telephone Company; Mahaska Communication Group; ImOn Communications; Grand Mound Cooperative Telephone Association; Onslow Cooperative Telephone Association; Killduff Telephone Company; Level 3 Communications; Heartland Net; Center Junction Telephone Company; The Community Agency; Harmony Telephone Company; Palo Cooperative Telephone Association; Independence Telecommunications Utility; Advanced Network Communications; Swisher Telephone Company; USA Communications; Spencer Municipal Utilities; Internet Solver; Louisa Communications; Indianola Communication Agency; Algona Municipal Utilities; Central Iowa Broadband; Milford Communications; Spring Grove Communications; WOW!; Guthrie Center Communications; Orange City Communications; Osage Municipal Utilities; CCS; Evertek; Harlan Municipal Utilities; Monarc Technologies; Lynnville Telephone Company; MMCTSU; Coon Rapids Municipal Communications Utility; IVUE; Grundy Center Municipal Utilities; Mapleton Communications Management Utility; Laurens Municipal Power & Communications; Tyson Communications; HiTec; Northland Communications; Lenox Municipal Utilities; Farmers Mutual Telephone Company; Altatec; Searsboro Telephone Company; VS Enterprises, LTD; WMTel.net; Woolstock Mutual Telephone Association; Cogent Communications.

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.

6.1.1.6. Utilities

Utilities are the essential systems that support daily operations in a community and cover a broad array of public services, such as electricity, water, wastewater, and solid waste. Section 6.1.4, Water Resources, describes the potable water sources in the state.

Electricity

The Iowa Utilities Board (IUB) regulates Iowa's electric utilities, including investor-owned utilities, municipal and rural electric cooperative utilities, though oversight differs for each. For investor-owned utilities, the IUBs jurisdiction includes regulation of utility rates and service quality. For both municipal utilities and rural cooperatives, the IUB only handles "service, safety and engineering issues" (IUB, 2015a). There are a total of 182 utilities under the IUBs jurisdiction, including 44 rural collectives, 2 investor-owned utilities, and 136 municipal utilities. These utilities generated 47,245,634 megawatthours[10] of power in 2014. Non-utility sources (such as colleges or hospitals) that may generate their own power generated 56,853,284 megawatthours in Iowa in 2014; nearly all of this electricity resulted from facilities using coal or wind as a source (IUB, 2015a). In 2014, 33,732,766 megawatthours (59 percent) came from coal sources and 16,306,756 (29 percent) was generated by wind power. In 2014, nuclear power provided about 4,152,468 megawatthours (7 percent), while other sources such as natural gas and biomass produced small amounts (EIA, 2015d). It should be noted that "in 2015, Iowa was ranked third among the states in the amount of net electricity generated from non-hydroelectric renewable energy resources" (EIA, 2015c). Almost half (49.3 percent) of the electricity used in the state is used by the industrial sector; and of the remaining power, 19.8 percent is used in transportation, 16.7 percent by residential users, and 14.2 percent by the commercial sector.

[10] One megawatt hour is defined as "one thousand kilowatt-hours or 1million watt-hours." One watt-hour can be defined as "the electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour." (EIA, 2016).

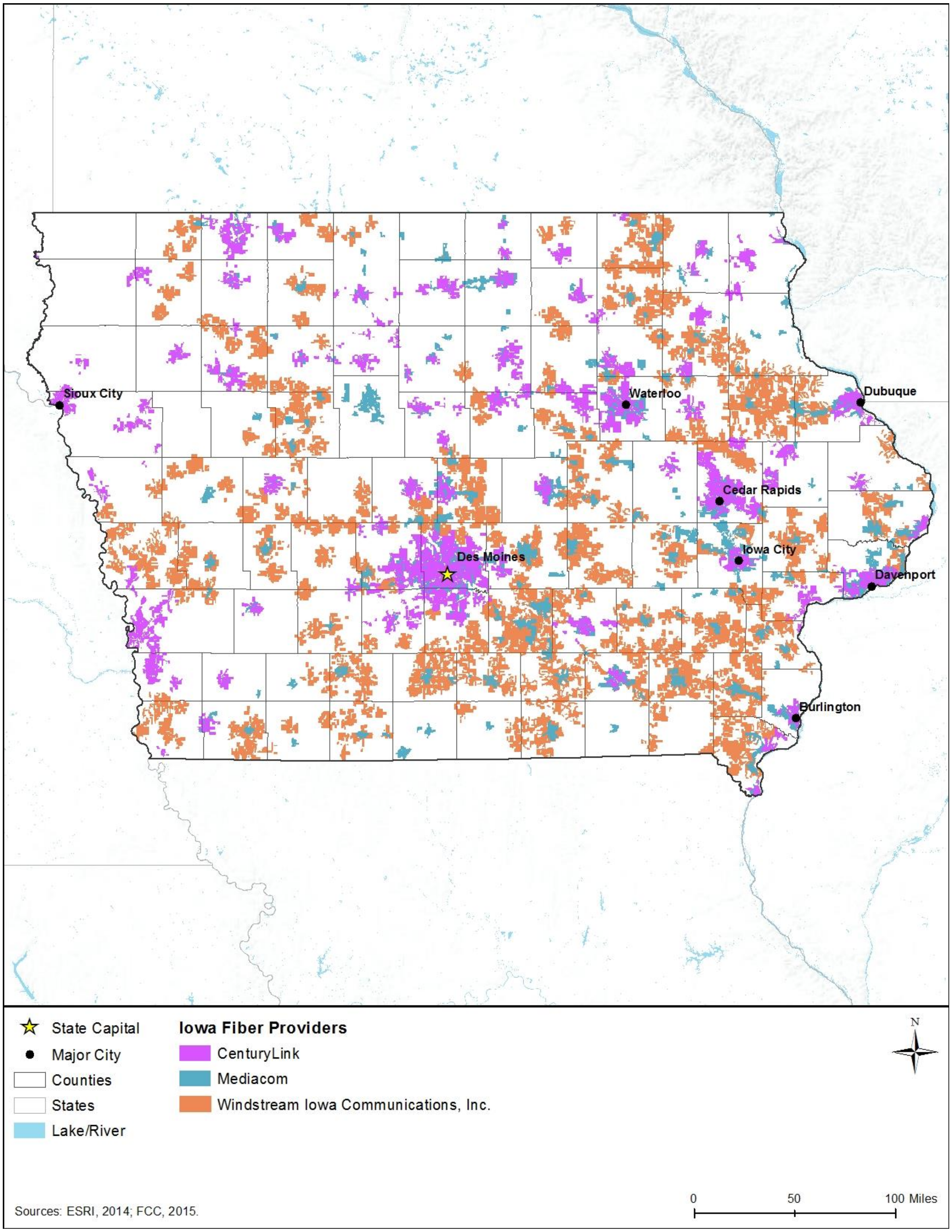


Figure 6.1.1-11: Fiber Availability in Iowa for CenturyLink, Mediacom, and Windstream Iowa Communications Inc.

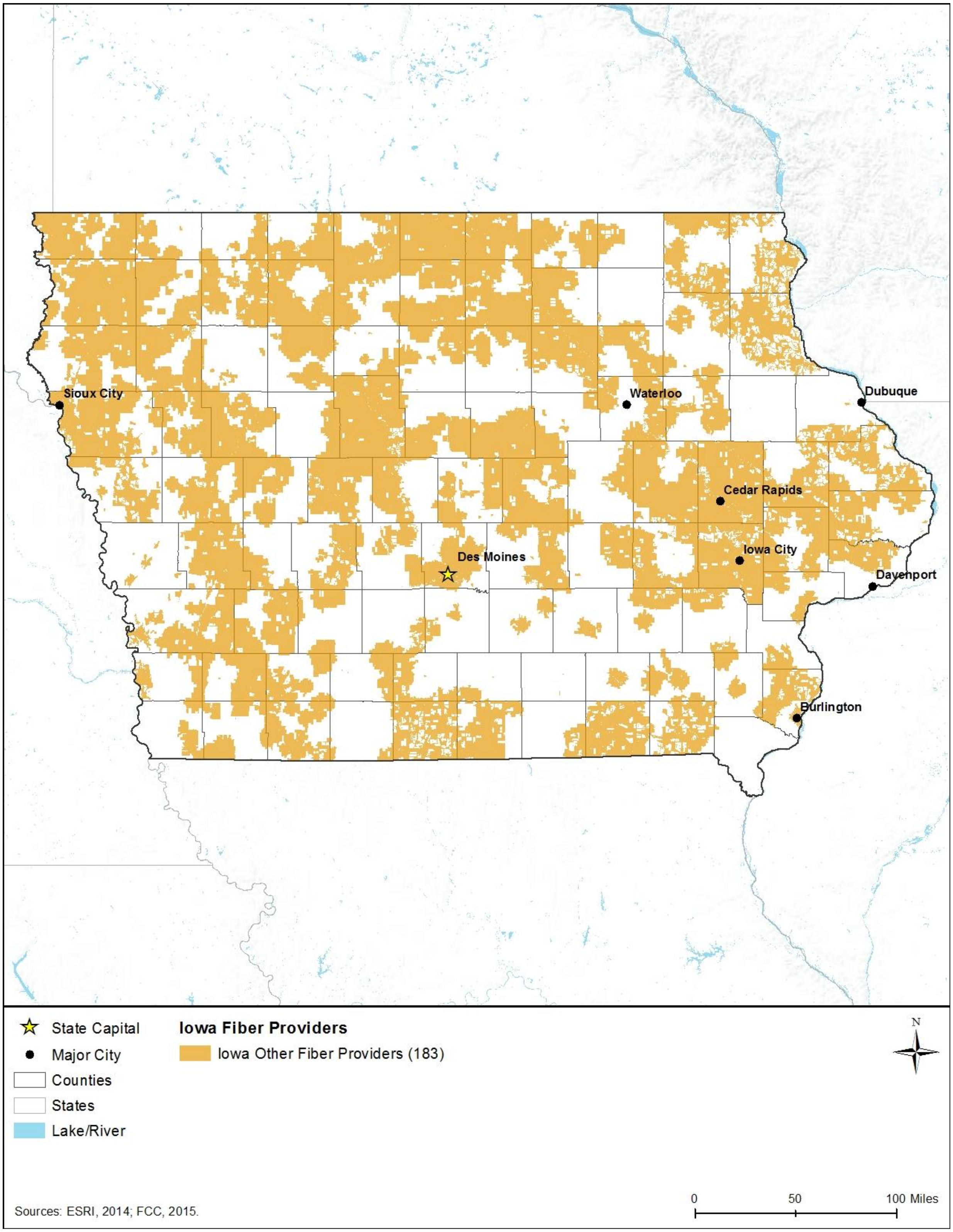


Figure 6.1.1-12: Other Provider's Fiber Availability in Iowa

Water

The IUB has regulatory authority over investor-owned water utilities, though there is just one such utility in the state. The Iowa-American Water Company serves over 54,000 people in the districts of Clinton and Davenport. Other types of facilities, such as municipal water providers or rural water districts, are not overseen by the IUB. These are governed by local authorities, city councils, or boards of trustees (IUB, 2015b). Iowa's Public Drinking Water Program is operated by the Iowa Department of Natural Resources (IDNR) whose authority is granted by the U.S. Environmental Protection Agency (USEPA). The IDNR is responsible for all programs regarding the state's water supply systems, and handle "water allocation and use program; environmental laboratory certification program; certification programs for water operators" among other things (IDNR, 2015a). Their oversight extends to all public water systems, which are defined as "system[s] that provides water for human consumption that has at least 15 service connections or serves at least 25 people at least 60 days during the year" (IDNR, 2015b).

The state Source Water Protection Program is a voluntary program designed to help identify sources of water and potential contaminants that may affect those areas (IDNR, 2016a). The program divides water supplies into two groups: targeted community supplies and non-target community supplies. Targeted water supplies include those with known contaminants, shallow alluvial wells or communities willing to address issues of contamination in their water supplies. Non-targeted community water supplies are those that do not meet criteria for the targeted grouping. The IDNR publishes reports twice each month, detailing the state of (or changes in) water conditions for the state, including information on precipitation, groundwater levels, stream flow or drought (IDNR, 2015c).

Wastewater

The management of Iowa's wastewater and treatment facilities is administered through the use of a series of permits issued by the IDNR. Construction of wastewater treatment or collection facilities, whether municipal or industrial, requires a permit from the Wastewater Engineering Section of the IDNR. Different permits are also required for onsite disposal systems such as septic tanks. The Wastewater Engineering Section also offers loans through its Wastewater State Revolving Fund Loan Program aimed at aiding the construction or improvement of wastewater systems (IDNR, 2015d). In addition to permitting construction, National Pollutant Discharge Elimination System (NPDES) permits, for the operation of wastewater facilities are also required, and are issued by the IDNR under authority of the national government. NPDES permits allow these facilities to discharge pollutants into bodies of water, though each permit specifies an allowable amount. The IDNR offers both individual and general permits; individual permits are specific to a given facility and general permits cover "multiple facilities within a specific category" (IDNR, 2015e). General permit categories include stormwater discharges, mining facility discharges, pesticide discharges, and discharges from private disposal systems (IDNR, 2015f). Much like the facilities they manage, wastewater facility operators must also be certified by the IDNR through the Water and Wastewater Operator Certification Program. This program aims to protect public health by ensuring operators are properly educated on wastewater topics (IDNR, 2015g).

Solid Waste Management

The management of Iowa's solid waste is handled by the IDNR, largely through permitting and reporting requirements imposed on waste management facilities and local governments (IDNR, 2015h). The IDNR issues permits for landfills (both municipal and industrial), electronic waste, composting facilities, processing facilities, and a number of other facilities (IDNR, 2015i). Between July 2013 and July 2014, Iowa's 46 landfills and 5 transfer stations accepted or moved 2.6 million tons of waste. The landfills and transfer stations also accepted 132,861 tons of waste from other states, and sent 76,327 tons out of state, compared to the average 2.8 million tons of waste that the state generates annually (IDNR, 2015h) (IDNR, 2015j). A study performed using data from 2011 outlined the types of materials included in municipal and residential waste. Organic materials comprised the largest percentage of waste for both municipal and residential waste streams, consisting of 25.5 percent and 31.7 percent of their respective totals. Paper products accounted for 25.2 percent of municipal waste products and 20.2 percent the total residential waste products. Waste plastic also contributed a significant portion to each category, representing 16.7 percent of municipal waste and 14.5 percent of residential waste (IDNR, 2011a). The Solid Waste Alternatives Program offers funding for projects seeking to reduce the aount of solid waste generated in the state. Among their funding options are "forgivable loans, zero interest loans, and 3 percent interest loans." These loans are available to projects in the areas of recycling and waste management education (IDNR, 2015z). Waste management planning is conducted on a city or county level, though these divisions often band together to form Solid Waste Planning Areas. The creation of a solid waste management plan by each Planning Area is required by the IDNR, and must be updated every five years (IDNR, 2015k).

6.1.2. Soils

6.1.2.1. Definition of the Resource

The Soil Science Society of America defines soil as:

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

6.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of the National Environmental Policy Act (NEPA) and other applicable laws and regulations. Applicable federal laws and regulations that apply for Soils, such as the Farmland Protection Policy Act of 1981, are in Section 1.8, Overview of Relevant Federal Laws and Executive Orders. A list of applicable state laws and regulations is included in Table 6.1.2-1 below.

Table 6.1.2-1: Relevant Iowa Soil Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
National Pollutant Discharge Elimination System (NPDES) General Permit No. 2	IDNR	Construction projects that disturb one acre or more are required to have soil erosion and sediment controls as part of the NPDES General Permit No. 2 stipulations

Source: (IDNR, 2015l)

6.1.2.3. Environmental Setting

Iowa is composed of one Land Resource Region (LRR),[11] the Central Feed Grains and Livestock Region, as defined by the National Resources Conservation Service (NRCS) (Natural Resources Conservation Service, 2006). Within and among Iowa's 1 LRR are 10 Major Land Resource Areas (MLRA),[12] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming (Natural Resources Conservation Service, 2006). The locations and characteristics of Iowa's MLRAs are presented in and Table 6.1.2-2.

Soil characteristics are an important consideration for FirstNet insomuch as soil properties could influence the suitability of sites for network deployment. Soil characteristics can differ over relatively short distances, reflecting differences in parent material, elevation, and position on the

[11] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (Natural Resources Conservation Service, 2006).
[12] Major Land Resource Area: "A geographic area, usually several thousand acres in extent, that is characterized by a particular pattern of soils, climate, water resources, land uses, and type of farming" (Natural Resources Conservation Service, 2006).

landscape, biota[13] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[14] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky, & Rogers, 2004). Soils can also be affected by a variety of surface uses that loosen topsoil and damage or remove vegetation or other groundcover, which may result in accelerated erosion, compaction, and rutting[15] (discussed further in the subsections below).

6.1.2.4. Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy[16]; there are 12 soil orders in the world and they are characterized by both observed and inferred[17] properties, such as texture, color, temperature, and moisture regime. Soil suborders are the next level down, and are differentiated within an order by soil moisture and temperature regimes, as well as dominant physical and chemical properties (Natural Resources Conservation Service, 2015e). FirstNet used the STATSGO2 database to obtain soils information at the programmatic level to ensure consistency across all the states and territories. This regional information provides a sufficient level of detail for a programmatic analysis. The best available soils data and information, including the use of the more detailed SSURGO database, will be used, as appropriate, during subsequent site-specific assessments. The STATSGO2[18] soil database identifies 13 different soil suborders in Iowa (Natural Resources Conservation Service, 2015a). Figure 6.1.2-2 depicts the distribution of the soil suborders, and Table 6.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[13] The flora and fauna of a region.
[14] Expansive soils are characterized by "the presence of swelling clay minerals" that absorb water molecules when wet and expand in size or shrink when dry leaving "voids in the soil" (Rogers, Olshansky, & Rogers, 2004).
[15] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).
[16] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA, 2015q).
[17] "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, 2016).
[18] STATSGO2 is the Digital General Soil Map of the United States developed by the National Cooperative Soil Survey and supersedes the State Soil Geographic (STATSGO) dataset; the U.S. General Soil Map is comprised of general soil association units and is maintained and distributed as a spatial and tabular dataset.

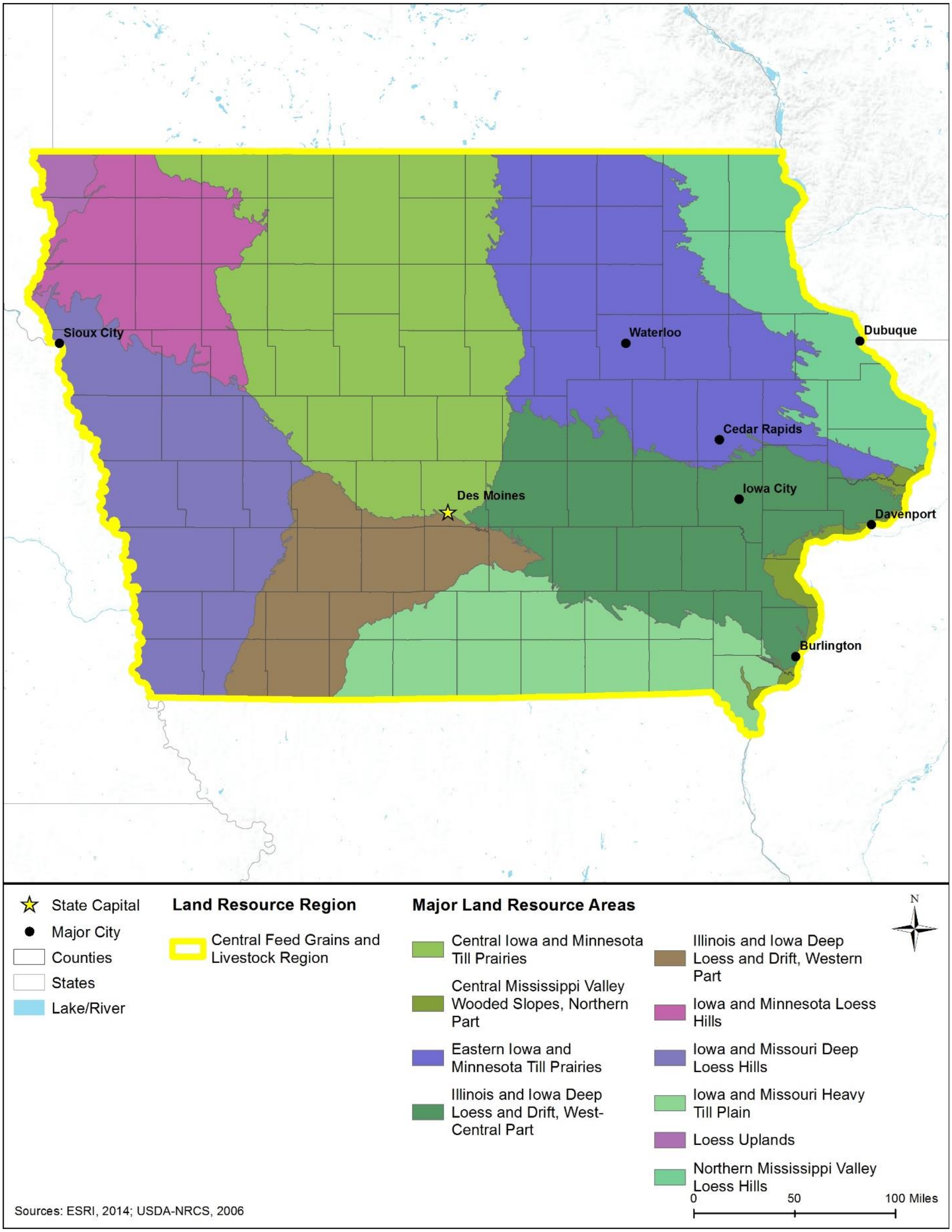


Figure 6.1.2-1: Locations of Major Land Resource Areas in Iowa

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

MLRA Name	Region of State	Soil Characteristics
Central Iowa and Minnesota Till Prairies	North central Iowa	Mollisols[a] are the dominant soil order, with Alfisols[b] and Inceptisols[c] less so. These soils range from very poorly drained to well drained, and are typically very deep and loamy.[d]
Central Mississippi Valley Wooded Slopes, Northern Part	Southeastern Iowa	Alfisols, Entisols,[e] Inceptisols, and Mollisols are the dominant soil orders. These soils range from excessively drained to poorly drained, and from very deep to very shallow. They are loamy, clayey, or silty.
Eastern Iowa and Minnesota Till Prairies	Northeastern Iowa	Alfisols and Mollisols are the dominant soil orders. These loamy and typically very deep soils range from very poorly drained to well drained.
Illinois and Iowa Deep Loess and Drift, West-Central Part	Southeastern Iowa	Mollisols is the dominant soil order, with Alfisols, Entisols, and Inceptisols less so. These soils range from poorly drained to well drained and are typically very deep. They are silty, clayey, or loamy.
Illinois and Iowa Deep Loess and Drift, Western Part	Southwestern Iowa	Alfisols and Mollisols are the dominant soil order, with Entisols less so. These loamy, silty, or clayey soils range from poorly drained to well drained, and are very deep.
Iowa and Minnesota Loess Hills	Northwestern Iowa	Mollisols is the dominant soil order.
Iowa and Missouri Deep Loess Hills	Southwestern Iowa	Mollisols is the dominant soil order, with Alfisols and Entisols less so. These loamy or silty soils are typically moderately well drained to well drained, and are very deep.
Iowa and Missouri Heavy Till Plain	Southern Iowa	Alfisols and Mollisols are the dominant soil orders. These soils range from poorly drained to well drained and are typically very deep. They are clayey or loamy.
Loess Uplands	Northwestern Iowa	Mollisols is the dominant soil order. These clayey or loamy soils are moderately well drained to somewhat excessively drained and range from very deep to shallow.
Northern Mississippi Valley Loess Hills	Northeastern Iowa	Alfisols and Entisols are the dominant soil orders, with Mollisols less so. These loamy soils are typically well drained or moderately well drained, and are moderately deep to very deep.

Source: (Natural Resources Conservation Service, 2006)

[a] 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)

[b] 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)

[c] 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)

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

[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)

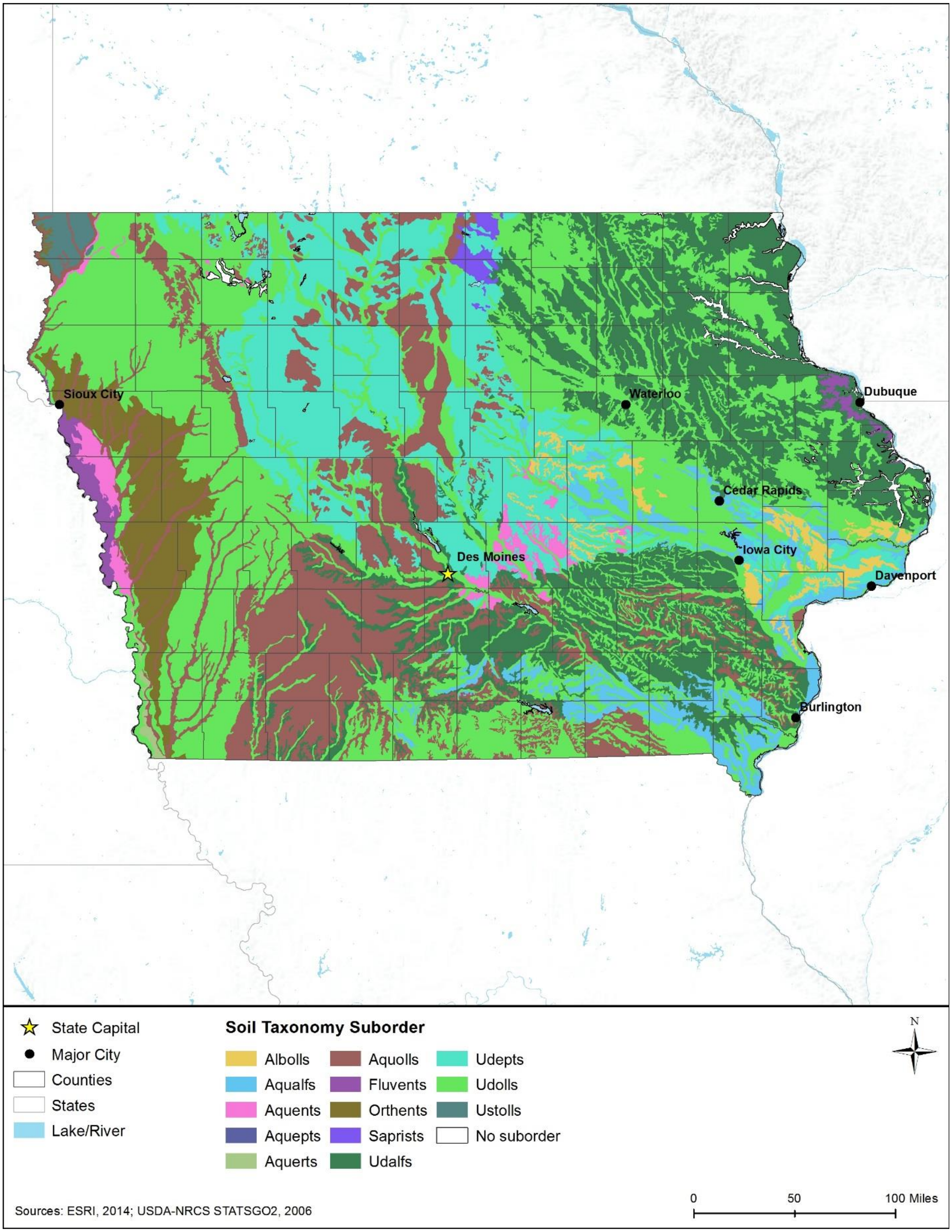


Figure 6.1.2-2: Iowa Soil Taxonomy Suborders

Table 6.1.2-3: Major Characteristics of Soil Suborders[19] Found in Iowa, as depicted in Figure 6.1.2-2

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	Limitation for Construction
Mollisols	Albolls	Albolls have a fluctuating groundwater table, with gentle slopes. They supported grasses and shrubs, and are typically used as cropland.	Silt loam	0-2	Very poorly drained	Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Aqualfs are used as cropland for growing corn, soybeans, and rice, and most have some artificial drainage or other water control. Nearly all Aqualfs have likely supported forest vegetation in the past.	Silt loam, Silty clay loam	0-5	Poorly drained to somewhat poorly drained	No, Yes	B, C	Medium	Moderate, Low	Medium	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
Entisols	Aquents	Widely distributed, with some forming in sandy deposits, and most forming in recent sediments. Aquents support vegetation that tolerates either permanent or periodic wetness, and are mostly used for pasture, cropland, forest, or wildlife habitat.	Silt loam, Silty clay, Stratified silt loam	0-3	Poorly drained to somewhat poorly drained	No, Yes	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
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.	Silty clay	0-1	Poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
Vertisols	Aquerts	Aquerts are wet soils, with prolonged moisture at or near the soil surface. Their natural vegetation includes savanna, grass, and forest. They are used as forest, rangeland, and cropland, although drainage for cropland can be difficult due to poor drainage.	Clay	0-2	Poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
Mollisols	Aquolls	Aquolls support grass, sedge, and forb vegetation, as well as some forest vegetation. However, most have been artificially drained and utilized as cropland.	Clay, Clay loam, Loam, Loamy sand, Sandy loam, Silt loam, Silty clay, Silty clay loam	0-9	Very poorly drained to somewhat poorly drained	Yes	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions	Erosion and Compaction
Entisols	Fluvents	Fluvents are mostly freely drained soils that form in recently deposited sediments on flood plains, fans, and deltas located along rivers and small streams. Unless protected by dams or levees, these soils frequently flood. Fluvents are normally utilized as rangeland, forest, pasture, or wildlife habitat, with some also used for cropland.	Fine sand, Silt loam	0-2	Moderately well drained	No	B	Medium	Moderate	Medium	Low	Erosion
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Silt loam	5-20	Well drained	No	B	Medium	Moderate	Medium	Low	Erosion
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.	Mucky peat	0-1	Very poorly drained	Yes	A, D	Low, High	High, Very Low	Low to High, depending on slope	High, due to hydric soil and poor drainage conditions	Erosion and Compaction

[19] 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	Limitation for Construction
Alfisols	Udalfs	Udalfs have an udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Clay loam, Loam, Loamy sand, Silt loam, Silty clay loam, Unweathered bedrock	2-35	Somewhat poorly drained to well drained	No	B, C	Medium, High	Moderate, Low	Medium to High, depending on slope	Low	Erosion
Inceptisols	Udepts	Udepts have an udic or perudic (saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the northwest and mixed or hardwood forest in the east. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture.	Loam, Silty clay loam	9-18	Moderately well drained to well drained	No	B	Medium	Moderate	Medium	Low	Erosion
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.	Clay loam, Fine sandy loam, Loam, Sand, Sandy clay loam, Silt loam, Silty clay, Silty clay loam	0-20	Somewhat poorly drained to excessively drained	No	A, B, C	Low, Medium	High, Moderate, Low	Low to Medium, depending on slope	Low	Erosion
Mollisols	Ustolls	Ustolls typically supported grass and forest vegetation, and are now primarily used as cropland or rangeland. They are generally freely drained, and found in subhumid to semiarid climates. Areas with drought are common, and blowing soil can be an issue.	Silt loam	0-2	Well drained	No	B	Medium	Moderate	Medium	Low	Erosion

Sources: (Natural Resources Conservation Service, 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" (Natural Resources Conservation Service, 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 Section 6.1.2.5

6.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[20] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 6.1.2-3 provides a summary of the runoff potential for each soil suborder in Iowa.

Group A **Sand, loamy sand or sandy loam soils.** This group of soils has "low runoff potential and high infiltration rates[21] 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). Saprists and Udolls fall into this category in Iowa.

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. Aqualfs, Aquents, Aquolls, Fluvents, Orthents, Udalfs, Udepts, Udolls, and Ustolls fall into this category in Iowa.

Group C **Sandy clay loam soils.** This group of soils has "low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure" (Purdue University, 2015). This group has medium runoff potential. Albolls, Aqualfs, Aquolls, Udalfs, and Udolls fall into this category in Iowa.

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). Albolls, Aquents, Aquepts, Aquerts, Aquolls, and Saprists fall into this category in Iowa.

6.1.2.6. Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public safety hazard (Natural Resources Conservation Service, 1996a). Table 6.1.2-3 provides a

[20] 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.
[21] 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).

summary of the erosion potential for each soil suborder in Iowa. Soils with medium to high erosion potential in Iowa include those in the Albolls, Aqualfs, Aquents, Aquepts, Aquerts, Aquolls, Fluvents, Orthents, Saprists, Udalfs, Udepts, Udolls, and Ustolls suborders, which are found throughout the state (Figure 6.1.2-2).

6.1.2.7. Soil Compaction and Rutting

Soil compaction and rutting occurs when soil layers are compressed by machinery or animals, which decreases both open spaces in the soil, as well as water infiltration rates (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 10 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 6.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Iowa. Soils with the highest potential for compaction and rutting in Iowa include those in the Albolls, Aqualfs, Aquents, Aquepts, Aquerts, Aquolls, and Saprists suborders, which are found throughout the state, including near major rivers (Figure 6.1.2-2).

6.1.3. Geology

6.1.3.1. Definition of the Resource

The U.S. Geological Survey (USGS) is the primary government organization responsible for the nation's geological resources. USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and ground-water availability. Several of these elements are discussed in other sections of this PEIS, including Water Resources (Section 6.1.4), Human Health and Safety (Section 6.1.15), and Climate Change (Section 6.1.14).

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

- Section 6.1.3.3, Environmental Setting: Physiographic Regions[22]and Provinces[23]
- Section 6.1.3.4, Surface Geology
- Section 6.1.3.5, Bedrock Geology[24]
- Section 6.1.3.6, Paleontological Resources[25]
- Section 6.1.3.7, Fossil Fuel and Mineral Resources
- Section 6.1.3.8, Geologic Hazards[26]

6.1.3.2. 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 6.1.3-1.

Table 6.1.3-1: Relevant Iowa Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Iowa State Building Code Bureau Adopted Codes	Iowa Department of Public Safety	Provides seismic guidelines for buildings

Source: (Iowa Department of Public Safety, 2015)

6.1.3.3. Physiographic Regions and Provinces

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

Iowa has one physiographic region: Interior Plains (Central Lowland Province) (USGS, 2009). The locations of this region are shown in Figure 6.1.3-1 and its general characteristics summarized in the following subsection.

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

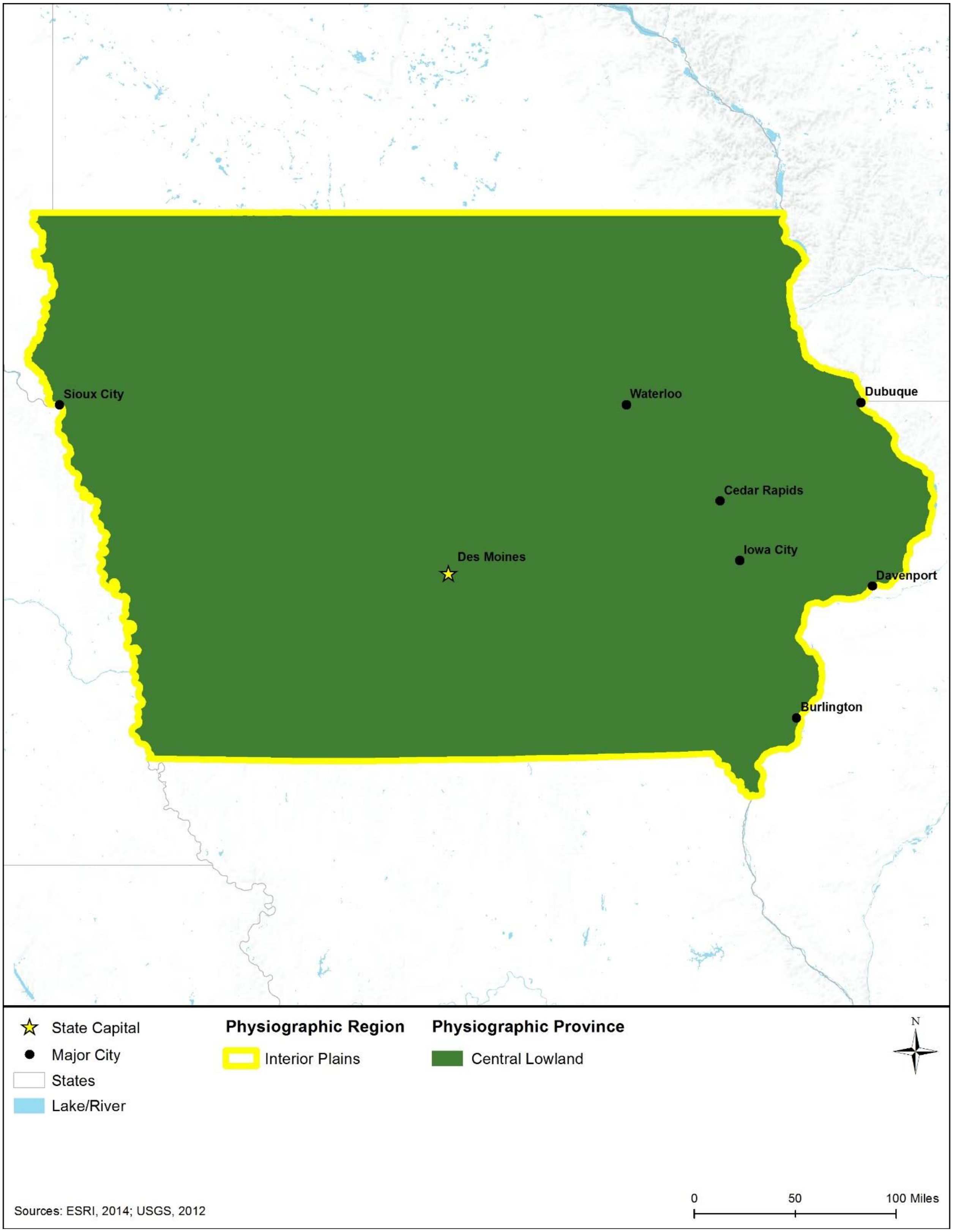


Figure 6.1.3-1: Physiographic Regions and Provinces of Iowa

Interior Plains Region

The Interior Plains Region extends across much of the interior of the United States, roughly between the western edge of the Appalachian Highlands (near states including Ohio, Tennessee, and Alabama), and the eastern edge of the Rocky Mountain System (including states such as Montana, Wyoming, and Colorado) (Fenneman, 1916). Metamorphic[27] and igneous[28] rocks dating to the Precambrian Era (older than 542 million years ago [MYA]) underlie the entire region.[29] There is minimal topographic relief throughout the region, except for the Black Hills of South Dakota. During the Mesozoic Era, much of the Interior Plains were covered by the oceans, resulting in the formation of sedimentary[30] rocks, which lie on top of the Precambrian basement rocks. Erosion from the Rocky Mountains to the west and the Ozark/Ouachita Mountains to the east, also contributed to the formation of sandstone,[31] mudstone,[32] and clay (USGS, 2014a).

<u>Central Lowland Province</u> – As the largest physiographic province in the United States, the Central Lowland Province includes more than 580,000 square miles and encompasses the eastern portion of the Interior Plains Region. Much of the region is flat lying and is at about 2,000 feet above sea level (ASL) (NPS, 2014a).

All of Iowa falls within the Central Lowland Province (Figure 6.1.3-1). Iowa is underlain by Paleozoic (542 to 251 MYA) and Mesozoic (251 to 66 MYA) sedimentary rocks which lay on top of crystalline igneous rocks. Portions of Iowa were impacted by glaciers, as were impacted by the Pleistocene glaciation which ended about 10,000 years ago. “Multiple glacial incursions into the area sculpted the bedrock surface, planed off loose and weathered rock, and deposited vast quantities of rock debris on the scoured bedrock surface” (USGS, 1992a). Topographic relief throughout the state is minimal with only 1,190 feet separating the highest and lowest points in the state (USGS, 2015h).[33]

On a more local scale, Iowa's physiography can be further subdivided into three units. The north-central portion of the state is underlain by till[34] deposits referred to as the Des Moines Lobe. Topographic relief in this area is generally less than 20 feet. Western portions of the state, immediately adjacent to the Missouri River floodplain, have “deep loess[35] soils that form very steep hillslopes and narrow drainage divides” (Lohnes, Kjartanson, & Barnes, 2001)

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[27] 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, 2015g).
[28] Igneous Rocks: “Rock formed when molten rock (magma) that has cooled and solidified (crystallized).” (USGS, 2015g).
[29] 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.
[30] Sedimentary Rock: “Rocks that formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding” (USGS, 2014c).
[31] Sandstone: “Sedimentary rock made mostly of sand-sized grains.” (USGS, 2015g).
[32] Mudstone: “A very fine-grained sedimentary rock formed from mud.” (USGS, 2015g).
[33] Iowa's highest point is Hawkeye Point in Osceola County which is in the northwestern corner of the state; Iowa's lowest point is at the Mississippi River in Lee County in the southeastern corner of the state. (USGS, 2015h).
[34] Till: “An unsorted and unstratified accumulation of glacial sediment, deposited directly by glacier ice. Till is a heterogeneous mixture of different sized material deposited by moving ice (lodgement till) or by the melting in-place of stagnant ice (ablation till). After deposition, some tills are reworked by water” (USGS, 2013b).
[35] Loess: “A wind-blown deposit of sediment made mostly of silt-sized grains.” (USGS, 2015g).

Topographic relief in this area is steeper, exceeding 150 feet in some locations. The remaining portions of Iowa are covered by loess between 8 and 32 feet in thickness; topographic relief ranges between 30 and 100 feet (Lohnes, Kjartanson, & Barnes, 2001).

6.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till, 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,[36] subsidence,[37] and erosion (Thompson, 2015).

Most of Iowa is covered in surface deposits, many of which are attributable to glaciation events within the last 2.5M years. The characteristics of these deposits are variable throughout the state. Much of western Iowa is covered in windblown loess deposits that date to the Pleistocene glaciation. Loess deposits generally range from 4 to 16 feet in thickness. These deposits are "only one to fifteen miles wide but [are] about 200 miles long extending from near Sioux City, Iowa to St. Joseph, Missouri" (IDNR, 2015m). Topographic relief approaches 200 feet in areas with the Pleistocene loess deposits. In the north-central part of the state, along the Des Moines Lobe, glacial moraines,[38] particularly terminal moraines, are common throughout the landscape. Southern Iowa is dominated by glacial till deposited by pre-Illinoian (about 2.5 to 0.5 MYA) glaciation. Loess regularly overtops the glacial till. In northeastern Iowa, surface deposits contain loess, along with glacial boulder deposits. In addition, alluvial deposits along the modern-day Missouri and Mississippi River floodplains contain boulders, cobbles, gravel, sand, silt, and clay (IDNR, 2015m). Figure 6.1.3-2 depicts an illustration of the general surficial composition of Iowa.

[36] 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).
[37] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000a).
[38] Moraine: "A hill-like pile of rock rubble located on or deposited by a glacier. An end moraine forms at the terminus of a glacier. A terminal moraine is an end moraine at the farthest advance of the glacier. A lateral moraine forms along the sides of a glacier." (USGS, 2015g).

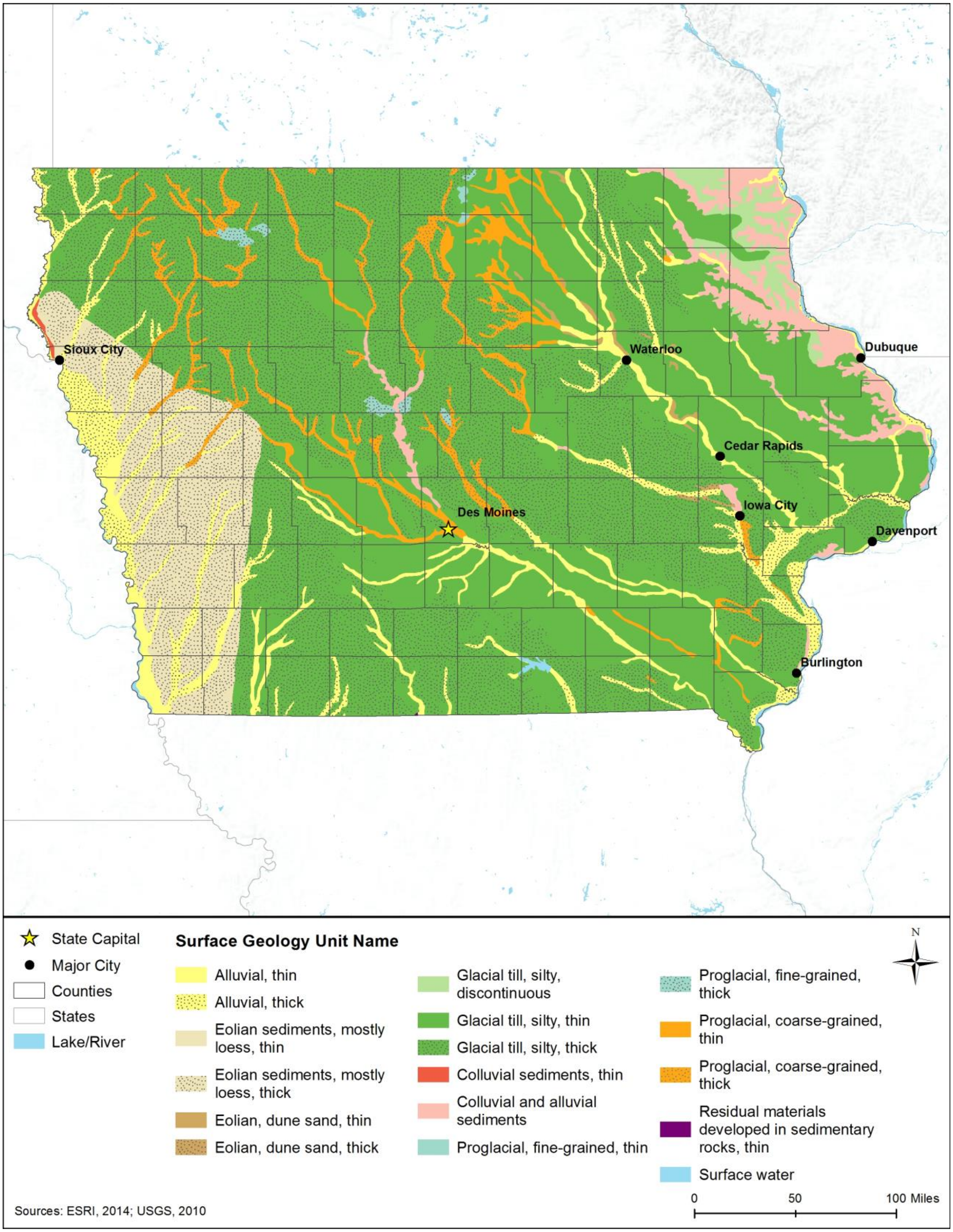


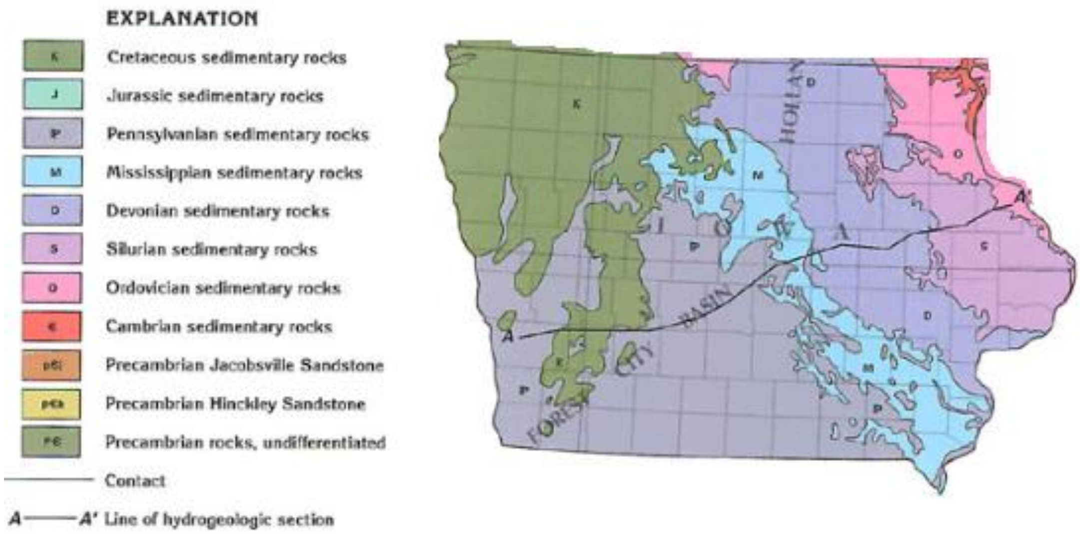
Figure 6.1.3-2: Generalized Surface Geology for Iowa

6.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015b) reveals important information about a region's surface and subsurface characteristics (i.e., three-dimensional geometry), including dip (slope of the formation),[39] rock composition, and regional tectonism.[40] 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).

As noted in Section 6.1.3.4, much of Iowa's ground surface is composed of glacial deposits dating from the Pleistocene glaciation (which ended roughly 10,000 years ago) (IDNR, 2015n). Beneath those surface deposits, Paleozoic (542 to 251 MYA) and Mesozoic (251 to 66 MYA) Era sedimentary bedrock primarily underlie Iowa. "Sediments were deposited as extensive sequences of sandstone, shale,[41] and limestone[42] or dolomite[43] that comprise the present-day sedimentary [rocks]" (USGS, 1992b) Cretaceous (146 to 66 MYA) and Pennsylvanian (318 to 299 MYA) bedrock is present in the uppermost units in the southwestern portion of the state (USGS, 1992c). Bedrock dips toward the southwest throughout the state, and older rocks rise toward the surface moving toward the northeast. Silurian (444 to 416 MYA) and Ordovician (488 to 444 MYA) bedrock surfaces in the northeastern portion of the state (USGS, 1992b). Figure 6.1.3-3 shows the general bedrock geology for Iowa.

[39] 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" (USGS, 2000b).
[40] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust." (USGS, 2016b).
[41] Shale: "Sedimentary rock derived from mud. Commonly finely laminated (bedded). Particles in shale are commonly clay minerals mixed with tiny grains of quartz eroded from pre-existing rocks." (USGS, 2015g).
[42] Limestone: "A sedimentary rock made mostly of the mineral calcite (calcium carbonate). Limestone is usually formed from shells of once-living organisms or other organic processes, but may also form by inorganic precipitation."
[43] Dolomite: "A magnesium-rich carbonate sedimentary rock. Also, a magnesium-rich carbonate mineral ($CaMgCO_3$)." (USGS, 2015g).



Source: (USGS, 1992c)

Figure 6.1.3-3: Generalized Bedrock Geology for Iowa

6.1.3.6. Paleontological Resources

During much of the Paleozoic Era (542 to 251 million years ago [MYA]), shallow, warm seas covered Iowa. Paleozoic sedimentary rocks yield marine fossils, including brachiopods,[44] cephalopods,[45] corals, trilobites,[46] mollusks, and bryozoans.[47] Later in the Paleozoic Era, the state was covered by swamps. Sea level fluctuated and periodically flooded the swamps, producing alternating layers of terrestrial and marine sediments that contain fossils from plants, amphibians, and fish. By the end of the Paleozoic Era, seas receded from Iowa, and massive erosion began. Sea levels fluctuated throughout the Mesozoic Era (251 to 66 MYA), as evidenced by fossils of swimming plesiosaurs in western Iowa. By the Cenozoic Era (66 MYA to present), Iowa was once again above sea level, and glaciers advanced and retreated across most of the state. Mammoth and mastodon fossils from this time have been found (NSF, 2015). There is no official state fossil for Iowa (Iowa Government, 2016).

[44] 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)
[45] 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)
[46] 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)
[47] Bryozoan: "Common name for any member of the phylum Bryozoa. Bryozoans are invertebrate aquatic organisms most commonly found in large colonies." (Smithsonian Institution, 2016)

6.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

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

Minerals

As of 2016, Iowa's total nonfuel mineral production was valued at $644M, which ranked 29th nationwide (in terms of dollar value). This level of production accounted for .86 percent of the country's total nonfuel mineral production. As of 2016, Iowa's leading nonfuel mineral commodities were crushed stone, Portland cement, construction and industrial sand and gravel, and lime. Other minerals produced in the state include common clay and shale, molybdenum, steel, and peat (USGS Mineral Commodity Summary, 2016).

While Iowa produced coal between the 1840s and 1994, there are no active coal mines in the state (EIA, 2015c).

6.1.3.8. Geologic Hazards

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

Earthquakes

Earthquake hazards in Iowa are minimal. Only 12 earthquakes originating in Iowa have been recorded since 1867(Iowa Geological Survey, 2015). 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. Earthquakes can produce secondary flooding impacts resulting from dam failure (USGS, 2012a).

The shaking due to earthquakes can be significant many miles from its point of origin depending on the type of earthquake and the type of rock and soils beneath a given location. Crustal earthquakes, the most common, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale.[48] 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. 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). Iowa is located far from any convergence boundaries (USGS, 2014e).

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

Figure 6.1.3-4 depicts the seismic risk throughout Iowa; the box surrounding the range of colors shows the seismic hazards in the state. Between 1973 and March 2012, there was one earthquake of a magnitude 2.5 (on the Richter scale) or greater in Iowa (USGS, 2014b). Figure 6.1.3-4 indicates levels of horizontal shaking (measured in Peak Ground Acceleration (PGA)) that have a 2 percent chance of being exceeded in a 50-year period. Units on the map are measured in terms of acceleration due to gravity (% g). Most pre-1965 buildings are likely to experience damage with exceedances of 10% g. Post-1985 buildings (in California) have experienced only minor damage with shaking of 60% g (USGS, 2010).

Landslides

Iowa is moderately susceptible to landslides in northeastern and central portions of the state (Radbruch-Hall, et al., 1982), while areas in eastern Iowa along the Mississippi River (e.g., south of Dubuque), and in western Iowa along the Missouri River, experience moderate incidence of landslide events (Lohnes, Kjartanson, & Barnes, 2001). "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, 2003). 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, 2003).

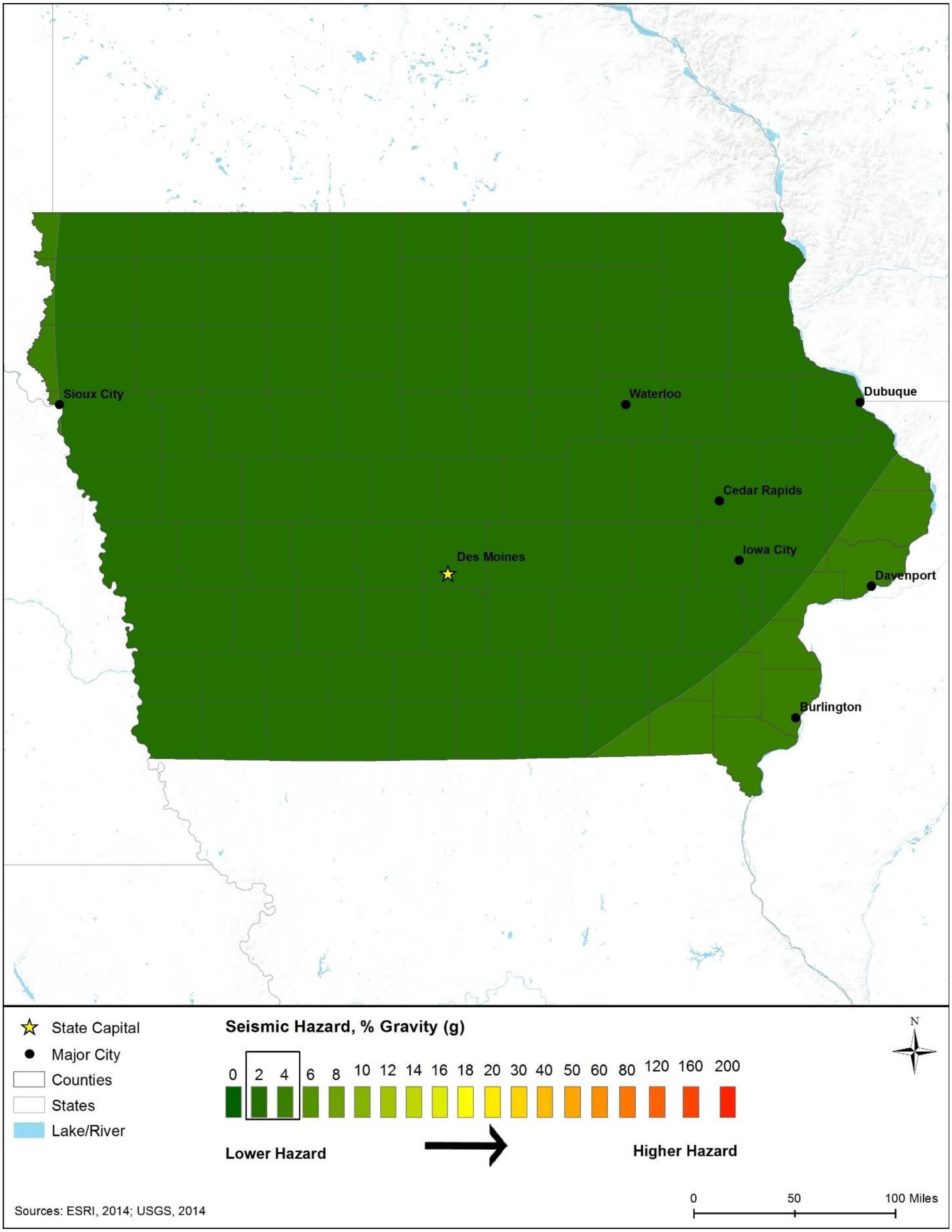


Figure 6.1.3-4: Iowa 2014 Seismic Hazard Map

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, 2003).

Areas in Iowa that are underlain by shale are especially vulnerable to landslide events (Lohnes, Kjartanson, & Barnes, 2001). Portions of eastern Iowa along the Mississippi River are particularly susceptible to landslides. In this area, the Edgewood Dolomite (Silurian Period [444 to 416 MYA]) overlies the Maquoketa Shale (Ordovician Period [488 to 444 MYA]); the underlying shale loses stability when wet. "In central Iowa, some DesMoinesian shale is moderately susceptible to landslides, particularly where weathered and overlain by loess or till, but not much sliding has occurred" (Radbruch-Hall, et al., 1982). The presence of unconsolidated sediments at the ground surface also contributes to landslide events in Iowa. Undifferentiated till (28 percent), glacial till (24 percent), and loess (21 percent) are present as surface deposits for the majority of landslides in Iowa. Nearly half of the landslide events in Iowa are associated with either heavy rainfall or elevated water tables (Lohnes, Kjartanson, & Barnes, 2001). Figure 6.1.3-5 shows landslide incidence and susceptibility throughout Iowa.

Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000a). In Iowa, land subsidence has been observed due to mine collapse events and karst[49] topography (Iowa Geological Survey, 2015). Nationwide, the primary causes of land subsidence are attributed to aquifer system compaction, drainage of organic soils, underground mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the United States is a consequence of over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If 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, 2000a).

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

[49] Karst Topography: "A distinctive landscape (topography) that can develop where the underlying bedrock, often limestone or marble, is partially dissolved by surface or groundwater." (USGS, 2015g).

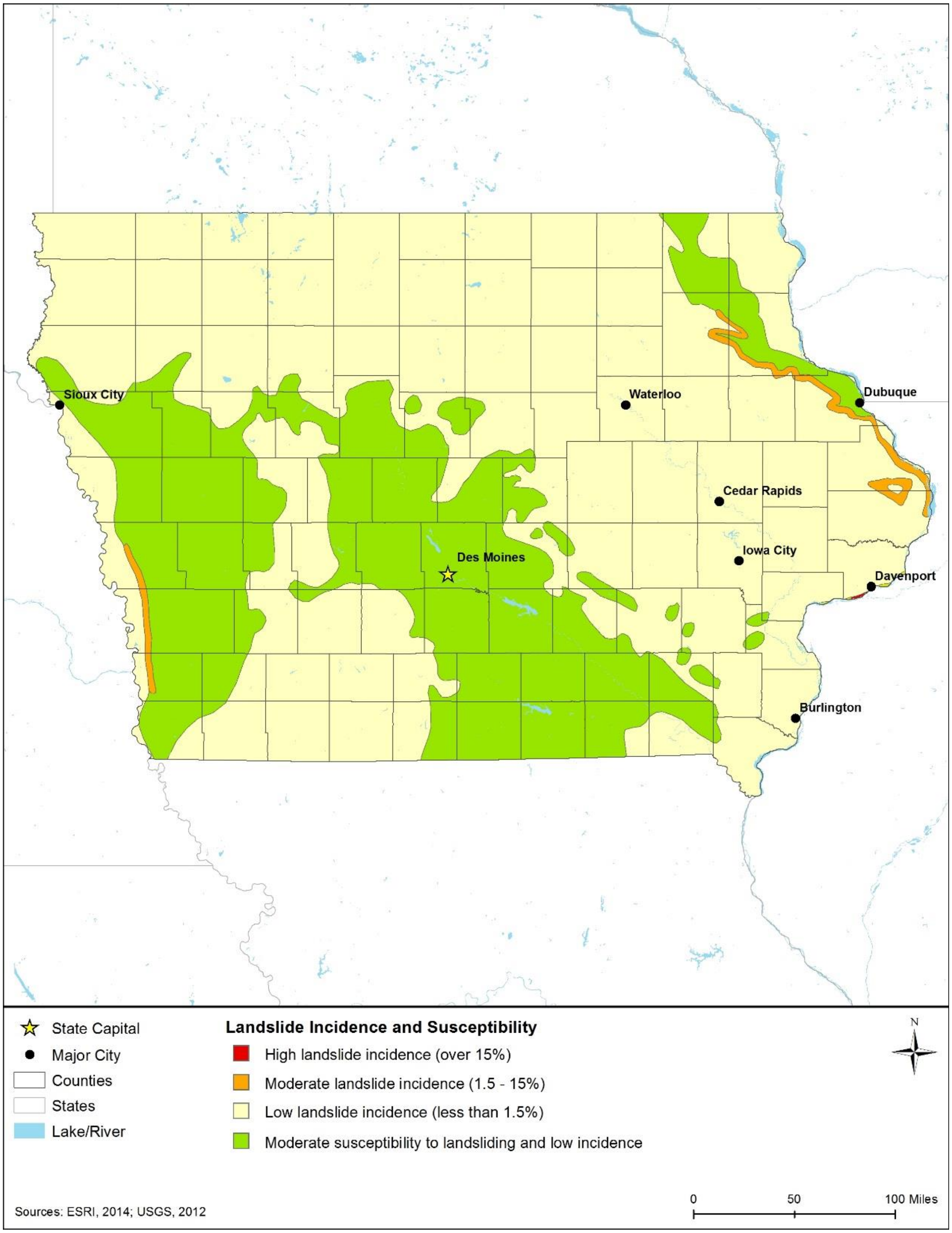


Figure 6.1.3-5: Iowa Landslide Incidence and Susceptibility Hazard Map[50]

[50] Susceptibility hazards not indicated in Figure 6.1.3-5 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, 2014f).

In Iowa, a significant cause of land subsidence is the collapse of karst. Sinkholes typically form in the eastern half of Iowa where overlying surface deposits are less than 50 feet thick. "There are three areas in Iowa where large numbers of sinkholes exist: (1) within the outcrop belt of the Ordovician Galena Group carbonates in Allamakee, Clayton, and Winneshiek counties; (2) in Devonian carbonates in Bremer, Butler, Chickasaw, and particularly Floyd and Mitchell counties; and (3) along the erosional edge of Silurian carbonates in Dubuque and Clayton counties" (Iowa Geological Survey, 2015). Figure 6.1.3-6 shows the location of areas in Iowa that are susceptible to land subsidence due to karst topography.

A second cause of land subsidence in Iowa is mine collapse, "by which the land surface sinks from collapse of the mine roof or failure of the support pillars." Up to 6,000 coal mines, affecting up to 80,000 acres of land, may exist in Iowa. Subsidence hazards related to these mines are expected to continue into the future (Iowa Geological Survey, 2015). Figure 6.1.3-7 displays the location of coal mines throughout the state.

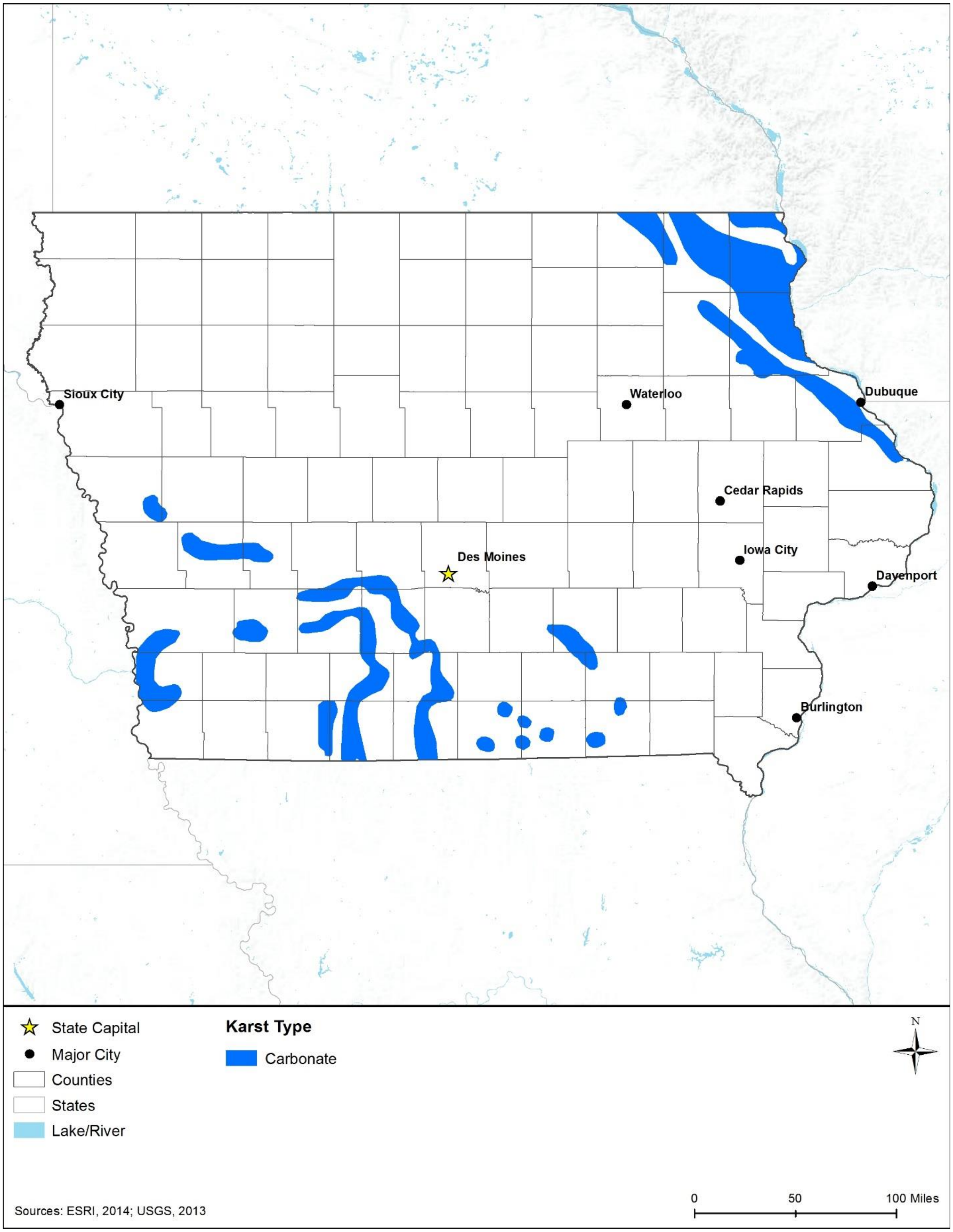


Figure 6.1.3-6: Areas Susceptible to Subsidence due to Karst Topography in Iowa

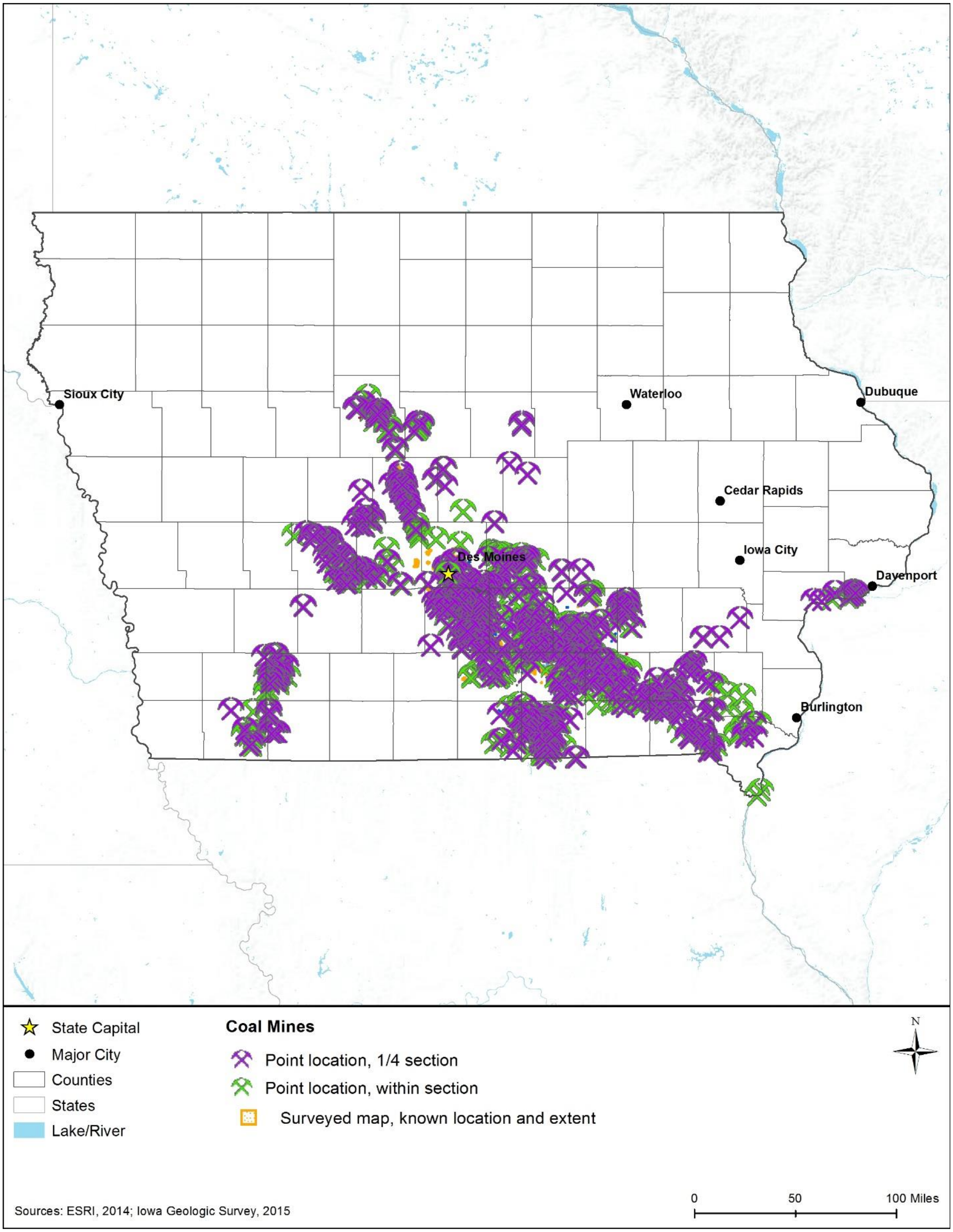


Figure 6.1.3-7: Locations of Iowa Coal Mines

6.1.4. Water Resources

6.1.4.1. Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 6.1.5). These resources can be grouped into watersheds, which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for 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).

6.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Section 1.8, Overview of Relevant Federal Laws and Executive Orders and Appendix C, Environmental Laws and Regulations. Table 6.1.4-1 identifies the relevant laws and regulations for water resources in Iowa.

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

State Law/ Regulation	Regulatory Agency	Applicability
General Water Regulations in Iowa	IDNR	Iowa water quality standards and all water programs can be found at: http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Quality-Standards.
Iowa NPDES	IDNR	All construction projects that disturb one or more acre of surface soil.
Sovereign Lands Construction Permit Program	IDNR	Any construction on or above state “Meandered Sovereign” rivers and lakes. Meandered Sovereign waters are state-owned waters that were transferred to the state when it was first admitted to the United States.
CWA Section 401 permit	IDNR	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 IDNR indicating that the proposed activity will not violate water quality standards.

Sources: (IDNR, 2015o)(IDNR, 2015p) (IDNR, 2009) (IDNR, 2015q)

6.1.4.3. Surface Water

Surface water resources are lakes, ponds, rivers, and streams. According to the USEPA, “Iowa has more than 71,000 miles of rivers and streams, over 200,000 acres of lakes, ponds, and reservoirs, and over 125,000 acres of wetlands.” These surface waters supply drinking water, aquatic habitat, and support recreation and fishing (USEPA, 2015a).

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). Iowa's waters (lakes, rivers, and streams) are divided into 19 watersheds, or drainage basins (Figure 6.1.4-1).

The Mississippi Watershed lies along the eastern border of the state, which is formed by the Mississippi River. The Iowa Watershed stretches from the northern border of the state to the southeast corner of the state and contains the Iowa River and Cedar River. The Des Moines Watershed is the largest in the state and extends from the northern border to the southern border of the state. The Des Moines Watershed contains the North Raccoon River and the Des Moines River. The western portion of the state is characterized by a series of smaller watersheds including the Big Sioux, Floyd, Monona, Missouri, Boyer, and Nishnabotna Watersheds. The eastern portion of the state also has a series of smaller watersheds including the Upper Iowa, Turkey, Maquoketa, and Wapsipinicon Watersheds. Other small watersheds in Iowa include the Blue Earth, Skunk, Chariton, Little Sioux, Grand, and Nodaway Watersheds (Iowa State University, 2015).

Freshwater

As shown in Figure 6.1.4-1, major rivers in Iowa include the Floyd, North Raccoon, Middle Nodaway, Des Moines, Cedar, Turkey, Iowa, Skunk, Missouri, and Mississippi Rivers. The Mississippi River forms the 300-mile eastern border of Iowa with Illinois, while the Big Sioux and Missouri Rivers form Iowa's western border. The Mississippi runs from the north to south, gradually widening as it goes south, with a river valley between two and six miles wide. The water is generally clear, except during flood conditions when it becomes muddy, and has an average flow of two miles per hour (IDNR, 2015ak).

Major lakes in Iowa include Lake Red Rock, Rathbun Lake, Okoboji Lake, and Saylorville Lake. Lake Red Rock (or Red Rock Reservoir), located in south-central Iowa, is one of the largest lakes in the state at over 15,000 square miles in size, with a maximum depth of 44 feet (IDNR, 2015ap). Rathbun Lake, also located in south-central Iowa is approximately 11,000 acres with a maximum depth of 50 feet (IDNR, 2015ao).

6.1.4.4. Sensitive or Protected Waterbodies

There are no federally designated National Wild and Scenic Rivers (National Wild and Scenic Rivers System, 2015a) in Iowa (National Wild and Scenic Rivers System, 2015b).

There are five state-protected scenic rivers and adjacent protected water areas: Wapsipinicon River, Middle Raccoon River, Upper Iowa River, Little Sioux River, and Boone River (as shown on Figure 6.1.4-1). The areas were selected with public input because of their "outstanding cultural and natural resource values" (IDNR, 2015aj).

Figure 6.1.4-1: Major Iowa Watersheds and Surface Waterbodies

6.1.4.5. 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,[51] the causes of impairment, and probable sources. Table 6.1.4-2 summarizes the water quality of Iowa's assessed major waterbodies by category, percent impaired, designated use,[52] cause, and probable sources. Figure 6.1.4-2 shows the Section 303(d) waters in Iowa as of 2014.

As shown in Table 6.1.4-2, various sources affect Iowa's waterbodies, causing impairments. More than half of Iowa's assessed rivers and streams, as well as lakes, reservoirs, and ponds, are impaired. The largest cause of water quality issues in Iowa is nonpoint source pollution,[53] particularly sediment and nutrient runoff from agricultural lands, urban areas, open spaces, roads, parking lots, and construction activities. Sediment runoff comes mostly from agricultural activities such as livestock in feedlots, woodlands, and pastures, as well as tilling of croplands. Sediment can also come from erosion of streambanks and lakeshores, as well as during construction activities. Nutrients, especially phosphorus and nitrogen, are common pollutants, and come from use of fertilizers on both agricultural and residential lands and from organic sources, including manure and human waste (IDNR, 2015al).

Table 6.1.4-2: Section 303(d) Impaired Waters of Iowa, 2012

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	14%	77%	Aquatic life, recreation, fishing, human health, primary and secondary contact recreation	Biological (fish and invertebrates), habitat alterations, pathogens[c]	Agriculture, hydromodification (alter natural flow), natural sources (wildlife), spills, habitat modification
Lakes, Reservoirs, and Ponds	45%	87%	Aquatic life, fishing, drinking water, and primary contact recreation	Turbidity, algal growth (chlorophyll A), and pathogens	Sediment resuspension, agriculture, natural sources (wildlife), internal nutrient cycling

Source: (USEPA, 2012a)

[a] Some waters may be considered for more than one water type

[b] Iowa has not assessed all waterbodies within the state.

[c] Pathogen: a bacterium, virus, or other microorganism that can cause disease (USEPA, 2015r)

51 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, 2015r).

52 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, 2015r).

53 Nonpoint source pollution: a source of pollution that does not have an identifiable, specific physical location or a defined discharge point. Non-point source pollution includes nutrients that run off croplands, lawns, parking lots, streets and other land uses. It also includes nutrients that enter waterways via air pollution groundwater, or septic systems (USEPA, 2015b).

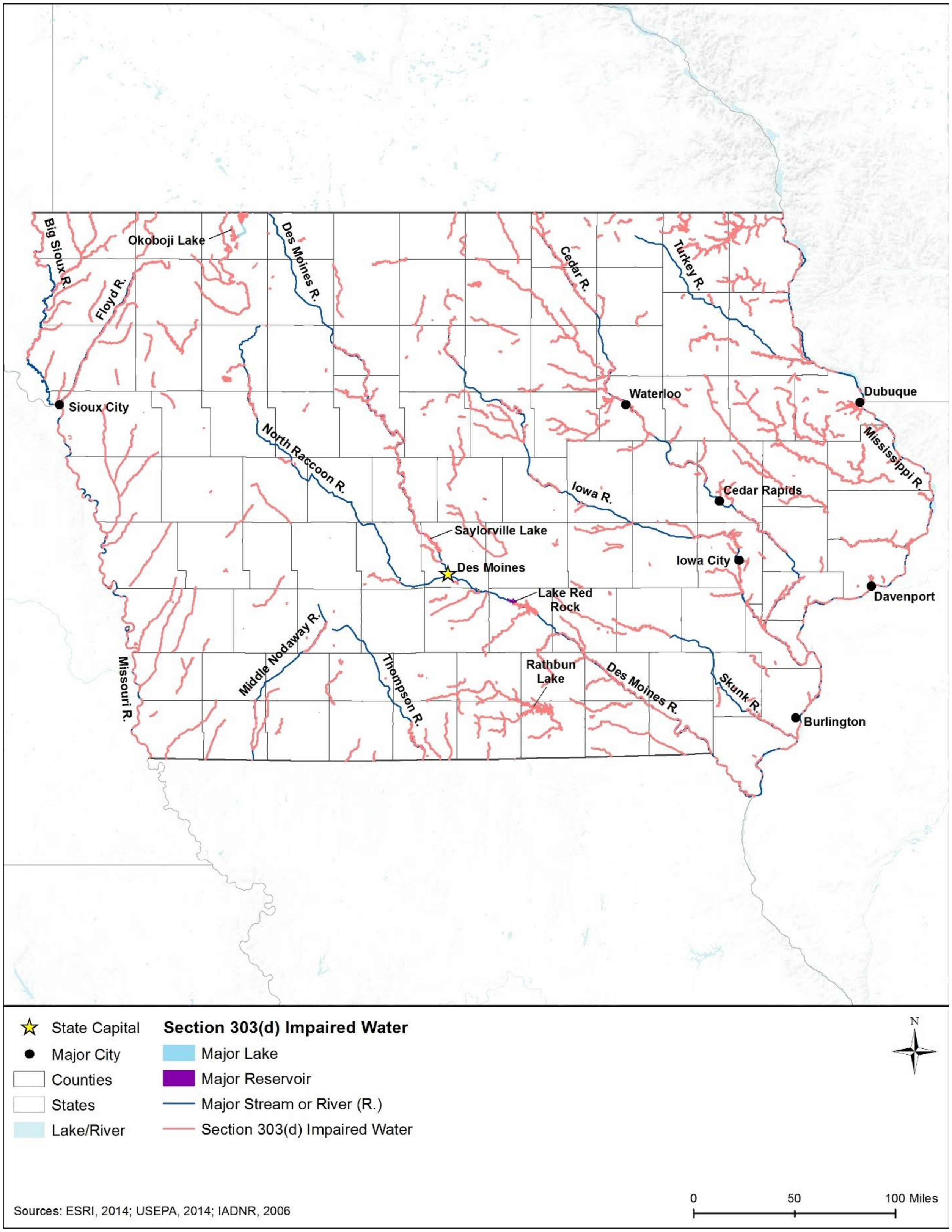


Figure 6.1.4-2: Section 303(d) Impaired Waters of Iowa, 2014

6.1.4.6. Floodplains

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

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

2008 Flooding

Iowa has experienced two 500-year flood events in the past two decades: the Flood of 1993 and the Flood of 2008, the latter of which is anticipated to be the fifth largest disaster on record in U.S. history according to Public Assistance figures from FEMA. In May and June of 2008, record-breaking flooding occurred. Snowfall and ice accumulations from the winter combined with above normal spring precipitation affected the Cedar, Des Moines, and Iowa Rivers, along with their tributaries. 86 of Iowa's 99 counties were declared state disaster areas, and 80 counties were also declared federal disaster areas. Damage across the state was estimated at around $10 billion, marking these floods the worst disaster to occur in the state (U.S. Department of Commerce, 2009).

Source: (U.S. Department of Commerce, 2009)

Riverine and lake floodplains are the primary type of floodplains in the state. They occur along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. In mountainous areas, floodwaters can build and recede quickly, with fast moving and deep water. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters.

Whereas, flatter floodplains may remain inundated for days or weeks covered by slow-moving and shallow water (FEMA, 2014b).

Flooding is the leading cause for disaster declaration by the President in the U.S. and results in significant damage throughout the state annually (NOAA, 2015c). River flooding, flash flooding, and flooding due to dam/levee failures are all common in Iowa, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment (Iowa Homeland Security and Emergency Management, 2013).

Since 1953, there have been 36 Presidential Disaster Declarations related to flooding in Iowa. Central and east-central Iowa have higher populations and development, and these areas also include some of the state's largest rivers. Therefore, these areas have the highest potential for losses from flooding, with Linn, Marshall, Johnson, and Polk counties having the highest potential (Iowa Homeland Security and Emergency Management, 2013).

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. FEMA provides floodplain management assistance, including mapping of 100-year floodplain limits, to 664 communities in Iowa through the National Flood Insurance Program (NFIP) (FEMA, 2014c). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015a). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, Iowa had seven communities participating in the CRS (FEMA, 2014d).[54]

6.1.4.7. Groundwater

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

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

Iowa's principal aquifers consist of sand and gravel aquifers of alluvial and glacial origin,[55] carbonate-rock,[56] and sandstone,[57] aquifers. Approximately 80 percent of Iowa's population draws drinking water from Iowa's groundwater resources. Generally, the water quality of Iowa's surficial and uppermost bedrock aquifers is suitable for drinking and daily water needs, with some limitations from naturally occurring dissolved solids, hardness, and radioactivity in some areas. Serious threats to groundwater also exist from human activities, particularly nitrate and pesticide contamination from agricultural operations (IDNR, 2003).

Table 6.1.4-3 provides details on aquifer characteristics in the state and Figure 6.1.4-3 shows Iowa's principal aquifers. There are no SSAs within Iowa (USEPA, 2016a).

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

Aquifer Type and Name	Location in State	Groundwater Quality
Aquifers of Alluvial and Glacial Origin/Surficial aquifers These aquifers consist mainly of the sand, gravel, and bedrock eroded by the glaciers	Found beneath major river and stream valleys or lake plains and terraces, all over the state.	Most water is very hard and generally suitable for most uses. In southern Iowa, water from the surficial aquifer system is hard and slightly basic (chalky) because the aquifers contain fragments of carbonate rocks. Elsewhere in Iowa, water from the surficial aquifer system is acidic and soft.
Cambrian-Ordovician aquifer system/Jordan aquifer Sandstone and dolomite	Northeastern section of Iowa	Source of drinking water for most of Iowa because of its large yields and the suitability of the water for most uses.
Lower Cretaceous aquifers/Dakota aquifer Sandstone	Occurs mainly in the western one-half of Iowa	Contains very hard water with high nitrate and dissolved-solids concentrations. Source of public, industrial, irrigation, and rural domestic water.
Mississippian aquifers Carbonate rock; limestone and dolomite	Occurs mainly in central Iowa	Water is very hard. Due to large concentrations of dissolved solids and small water yields the aquifer is not a source of drinking water.
Silurian-Devonian aquifers Carbonate rock; limestone and dolomite	Most of north central and eastern Iowa	Readily available source of water for most uses, although water may not be suitable for drinking in areas because of naturally occurring sulfate and dissolved solids. The aquifer is near or at the land surface in much of northeastern Iowa, making it susceptible to surface contamination.
Upper carbonate aquifer Carbonate rocks, shale and dolomite	Northern central Iowa	The thinness or absence of overlying glacial deposits along the eastern edge of the aquifer makes this part of the aquifer susceptible to contamination from the surface.

Sources: (Moody, Carr, Chase, & Paulson, 1986) (USGS, 1992d) (USGS, 1992e) (Prior, Boekhoff, Howes, Libra, & VanDorpe, 2003)

[55] Sand and gravel aquifers of alluvial (sand, silt, or gravel materials left by river waters) and glacial origin are highly productive aquifers in the northern part of the country, consisting of mostly sand and gravel deposits formed by melting glaciers (USGS, 2015i).

[56] Carbonate-rock aquifers typically consist of limestone with highly variable water-yielding properties (some yield almost no water and others are highly productive aquifers) (USGS, 1992d).

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

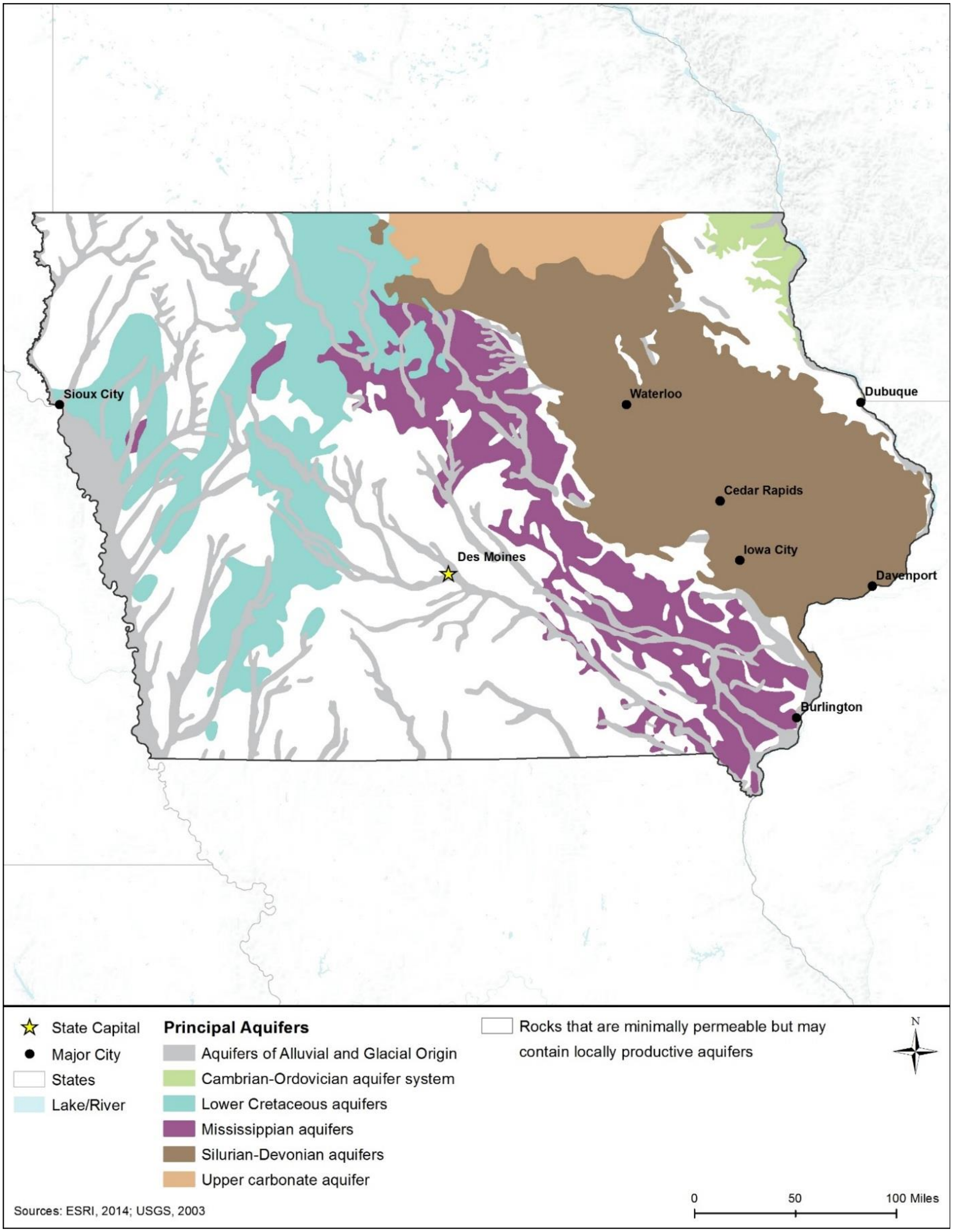


Figure 6.1.4-3: Principal Aquifers of Iowa

6.1.5. Wetlands

6.1.5.1. Definition of the Resource

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

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

6.1.5.2. Specific Regulatory Considerations

Section 1.8, Overview of Relevant Federal Laws and Executive Orders and Appendix C, Environmental Laws and Regulations, describe the pertinent federal laws protecting wetlands in detail. Table 6.1.5-1 summarizes the major Iowa state laws and permitting requirements relevant to the state's wetlands.

Table 6.1.5-1: Relevant Iowa Wetlands Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
Iowa Pollutant Discharge Elimination System	IDNR	All construction projects that disturb one or more acre of surface soil.
Sovereign Lands Construction Permit Program	IDNR	Any construction on or above state "Meandered Sovereign" rivers and lakes. Meandered Sovereign waters are state-owned waters that were transferred to the state when it was first admitted to the United States.
CWA Section 401 permit	IDNR	In accordance with Section 401 of the CWA, activities that may result in a discharge to lakes, wetlands, or on the floodplains require a Water Quality Certification from IDNR indicating that the proposed activity will not violate water quality standards
Iowa Floodplain Management (Iowa Code 455B)	IDNR	Wetlands that constitute "floodplains" or "floodways" in the state are regulated. IDNR has authority to regulate construction on all floodplains and floodways in the state

Sources: (IDNR, 2015o)(IDNR, 2015p) (IDNR, 2009) (IDNR, 2015q), (IDNR, 2015r).

6.1.5.3. 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 (USFWS, 2015a). Three of these systems—Palustrine, Riverine, and Lacustrine—are present in Iowa, as detailed in Table 6.1.5-2.

- 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 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 plants, or emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent." The System is characterized based on the type and duration of flooding, water chemistry, vegetation, or substrate characteristics (soil types) (Cowardin et al., 1979) (FGDC, 2013).

In Iowa, the main type (91 percent) of wetlands is palustrine (freshwater) wetlands found across the state, as shown in Figure 6.1.5-1.[58] Riverine and lacustrine wetlands comprise approximately six and three percent, respectively, of the other wetlands in the state. (USFWS, 2014a)

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

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

Table 6.1.5-2: Iowa 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 is at least 20 feet tall. Floodplain forests and hardwood swamps are examples of PFO wetlands.	Forested lowlands within the state	336,192
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.	Often on river and lake floodplains	
Palustrine emergent wetlands	PEM	PEM wetlands have erect, rooted, green-stemmed, annual, water-loving plants present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens[c], prairie potholes, and sloughs[d].	Throughout the state, in low-lying areas in floodplains. Concentrated in the Prairie Pothole Region (northcentral)	208,910
Palustrine unconsolidated bottom	PUB	PUB and PAB wetlands are commonly known as freshwater ponds, and include all wetlands with at least 25% cover of particles smaller than stones and a vegetative cover less than 30%.	Scattered throughout state	110,770
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Other Palustrine wetland	Misc. Types	Farmed wetland, saline seep[e], and other miscellaneous wetlands are included in this group.	Abandoned fields, depressions (seeps), along hillsides and highways	3,346
Riverine wetland	R	R systems include rivers, creeks, and streams. They are contained in natural or artificial channels periodically or continuously containing flowing water.	Throughout the state, many in the southeast	45,299
Lacustrine wetland	L2	L2 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.	Southern half of the state	18,611
			TOTAL	**723,128**

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

[a] The wetlands descriptions are based on information from the Federal Geographic Data Committee (FGDC)'s Classification of Wetland and Deepwater Habitats of the United States. Based on Cowardin, et al., 1979, some data has been revised based on the latest scientific advances. The USFWS uses these standards as the minimum guidelines for wetlands mapping efforts (FGDC, 2013).
[b] All acreages are rounded to the nearest whole number. The maps are prepared from the analysis of high altitude imagery. A margin of error is inherent in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted (USFWS, 2015b).
[c] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water (Edinger, et al., 2014).
[d] Slough: "swamp or shallow lake system, usually a backwater to a larger body of water" (NOAA, 2014).
[e] Saline seep is an area where saline groundwater discharges at the soil surface. Saline (salty) soils and salt tolerant plants characterize these wetlands (City of Lincoln, 2015).

Palustrine Wetlands

In Iowa, palustrine wetlands include the majority (91 percent) of freshwater wetlands (freshwater marshes, swamps, bogs, and ponds) (USFWS, 2014a). Common tree types found in palustrine forested (PFO) wetlands in Iowa are cottonwood *(Populus deltoids)*, willow *(Salix sp.)*, and green ash *(Fraxinus pennsylvanica)* that tolerate wet soils within uplands or bottomlands. Isolated forested wetlands (vernal pools) are usually small, temporarily ponded rainwater-fed pools that are very important breeding habitat for woodland amphibians. Bottomland forested wetlands typically occur within the floodplain of streams and rivers with high water tables and frequent flood events. Palustrine scrub-shrub wetlands (PSS) in Iowa consist of willows, dogwoods (*Cornus spp*.), arrowwoods (*Viburnum spp.*), highbush blueberries (*Vaccinium spp.*), buttonbush (*Cephalanthus occidentalis*), and saplings of trees such as red maple (*Acer rubrum*). PFO and PSS are the most common type of palustrine wetlands within Iowa. Palustrine emergent wetlands (PEM), or freshwater marsh, fen, prairie pothole, and slough, in Iowa support diverse plant and animal populations. Common PEM marsh plants in Iowa include cattail (*Typha*), bulrush (*Scirpus sp.*), and horsetail (*Equisetum sp.*) (IDNR, 2007).

PEM wetlands may occur within uplands, such as the prairie potholes, where they are fed by rain and groundwater, or on bottomlands, such as oxbows (U-shaped lakes or rivers), where they receive surface water, groundwater and flood waters of adjacent streams or rivers. (IDNR, 2007)

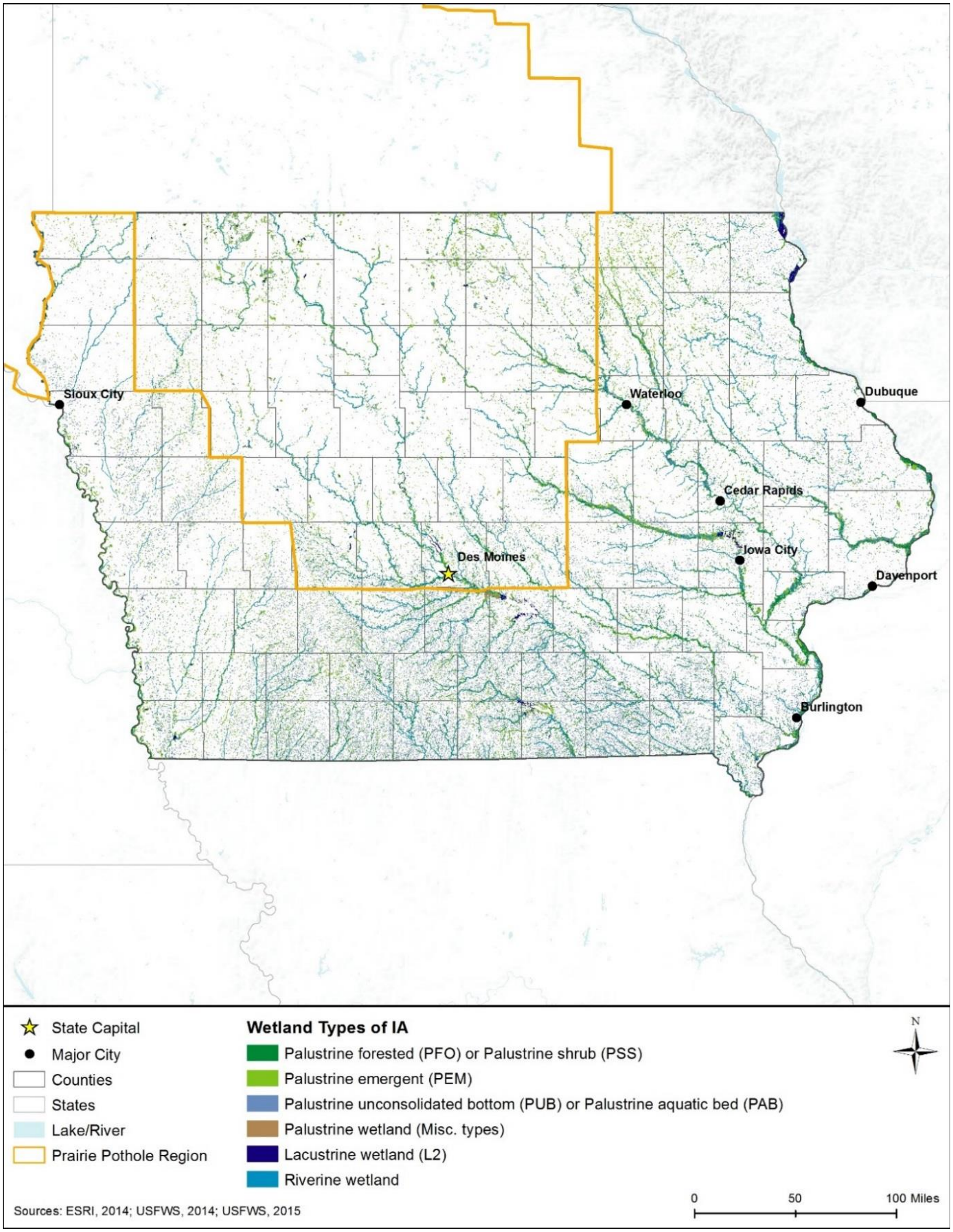


Figure 6.1.5-1: Wetlands by Type, in Iowa, 2014

Fens are nutrient-rich, grass- and sedge[59]-dominated PEM wetlands that are recharged from groundwater and have continuous running water. This wet meadow habitat supports distinctive plant communities, including many species that are restricted to Iowa. Fens are found throughout Iowa with the highest density of fen wetlands occurring in northwest Iowa and in the north-central prairie-pothole area, although they are uncommon elsewhere in the state. Many of Iowa's fens have been drained for row crops, heavily grazed, or excavated into ponds. Few undisturbed, high-quality fens are known to remain in Iowa (IDNR, 2007).

The Prairie Pothole Region extends north and west into western Minnesota, eastern North and South Dakota, Alberta, Saskatchewan, and Manitoba. This area contains millions of depressional (PEM) wetlands that constitute one of the richest wetland complexes in the world. Prior to settlement, the Iowa extent of the Prairie Pothole Region contained 3.5 million acres of wetlands. Historically, these wet meadows were the most common type of wetland in Iowa. In addition to surface runoff and overflow from depressions, these wet meadows and flats received groundwater and precipitation inputs that could be a dominant water source in very dry years (IDNR, 2010a) (Iowa Association of Naturalists, 2001).

Palustrine aquatic (PAB/PUB) wetlands also include the shallow water zones of lakes, rivers, and ponds and aquatic beds formed by water lilies and other floating-leaved or free-floating plants. These are the easiest wetlands to recognize and occur throughout the state. (IDNR, 2010a).

Riverine Wetlands

Within the Prairie Pothole Region, there are two dominant wetland classes, depressional wetlands ("prairie potholes") and riverine wetlands. Riverine wetlands are associated with flowing water systems (such as rivers, creeks, perennial streams, intermittent streams, and similar waterbodies) and contiguous wetlands (Figure 6.1.5-2) (IDNR, 2010a). These wetland types are often fringing wetlands of small widths along river edges or occasionally meadows. The Mississippi River and other rivers and streams sometimes have associated riverine wetlands (Iowa Association of Naturalists, 2001). Riverine wetlands comprise six percent of total wetlands in the state (USFWS, 2014a).

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

Source: (Betts, 2011)

Figure 6.1.5-2: Riverine Wetlands in Northwest Iowa

Lacustrine Wetlands

Lacustrine wetlands include both open lake water and the shallow edges of lakes. In Iowa, lacustrine wetlands hold water year-round, and are important sources of recreation and habitats for fish. There are more than 18,611 acres of lacustrine wetlands in the state, or approximately 3 percent of all the wetlands, and are found along the southern part of the state (USFWS, 2014a). All of Iowa's large lakes have associated wetlands (Iowa Association of Naturalists, 2001).

Status and Trends

Prior to European settlement, Iowa had 4 to 6 million acres of wetlands. By 1906, 1 million acres of wetlands remained (IDNR, 2010a). Based on the USFWS NWI 2014 analysis, there are 723,128 acres of wetlands in the state. PFO/PSS wetlands are the dominant palustrine wetland type (51 percent), followed by PEM (32 percent), PUB/PAB (ponds) (17 percent), and other palustrine wetlands (1 percent) (USFWS, 2014a). There are currently about 659,200 acres of palustrine (freshwater) wetlands in the state (USFWS, 2014a). Main threats to wetlands in Iowa include invasive plant species (reed canary grass [*Phalaris arundinacea*] and hybrid cattail [*Typha glauca*]), agricultural run-off containing high concentrations of herbicides and nutrients (nitrogen and phosphorus), wetland draining, tiling, ditching, and urban development (IDNR, 2010a) (Iowa Association of Naturalists, 2001).

Important Wetland Sites in Iowa

- Wildlife Management Areas (WMAs) are designated for outdoor recreation; IDNR's Wildlife Bureau, manages these 356,000 acres of public lands, with many home to wetlands. To learn more about state WMAs, visit www.iowadnr.gov/Hunting/Places-to-Hunt-Shoot/Wildlife-Management-Areas.
- National Natural Landmarks in Iowa range in size from 120 acres to almost 700 acres, and are owned by IDNR, conservation organizations, and individuals. Sites include glacial pothole lakes and a nearly 700-acre slough. (NPS, 2012a) Section 6.1.8, Visual Resources, describes Iowa's National Natural Landmarks.
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state. Easement holders include NRCS 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, Indian Creek Nature Center, and the state. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), roughly 174,000 acres in conservation easements are held in Iowa, more than 50,000 acres of which are in the Prairie Pothole Region. (NCED, 2015)

6.1.6. Biological Resources

6.1.6.1. Definition of the Resource

This section describes the biological resources of Iowa. Biological resources include terrestrial[60] vegetation, wildlife, fisheries and aquatic habitats,[61] and threatened[62] and endangered[63] species as well as species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Iowa's history of settlement, development, and agriculture have greatly modified the native prairies and hardwood forests, resulting in a highly homogenous landscape with 80 percent of the land used for agricultural purposes (USDA, 2012). The remaining portion of land use in the state includes grasslands in the form of conservation reserve, road ditches, or pasture lands, with very little remaining land as forest, savanna, or wetlands. Even with the highly developed landscape, Iowa contains a variety of habitats including tallgrass prairie, savanna, hardwood forests, wetlands, lakes, streams, and rivers that support a diversity of biological resources. Each of these topics is discussed in more detail below.

[60] Terrestrial: "Pertaining to the land" (USEPA, 2015q).
[61] Habitat: "The environment in which an organism or population of plants or animals lives; the normal kind of location inhabited by a plant or animal" (USEPA, 2015q).
[62] 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" (USEPA, 2015q).
[63] Endangered species are "any species which is in danger of extinction throughout all or a significant portion of its range." (USEPA, 2015q).

6.1.6.2. Specific Regulatory Considerations

The federal laws relevant to the protection and management of biological resources in Iowa are summarized in detail in Section 1.8, Overview of Relevant Federal Laws and Executive Orders and Appendix C, Environmental Laws and Regulations. Table 6.1.6-1 summarizes state laws relevant to Iowa's biological resources.

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

Law/Regulation	Regulatory Agency	Applicability
Endangered Plants and Wildlife (Iowa Code 481B)	IDNR	Provides protection against the taking, possessing, purchasing, selling, or transportation of wildlife or plants that are members of an endangered or threatened species. IDNR may designate a state list of endangered and threatened species; carries out programs and studies for species conservation and management.
Iowa Weed Law (Iowa Code 317) and Noxious Weeds (Iowa Code 317.1A, last updated 2014)	Iowa Department of Agriculture and Land Stewardship (IDALS)	Establishes a program for the control and monitoring of noxious weeds, establishment of noxious weed species, public education, and administration of noxious weed control laws at the county level.
Aquatic Invasive Species (Iowa Code 571.90)	IDNR	Regulates the introduction and transportation of aquatic invasive species

Source: (Iowa Department of Legislature, 2017a), (Iowa Department of Legislature, 2017b), (Iowa Department of Legislature, 2017c), (Iowa Department of Legislature, 2015)

6.1.6.3. Terrestrial Vegetation

The distribution of flora within Iowa is a function of the characteristic geology,[64] soils, climate,[65] and water of a given geographic area and correlates with distinct areas identified as ecoregions.[66] Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions and represent ecosystems of regional extent. The boundaries of an ecoregion are not fixed, but rather depict a general area with similar ecosystem types, functions, and qualities (National Wildlife Federation, 2015) (USDA, 2015a) (World Wildlife Fund, 2015).

Ecoregion boundaries often coincide with physiographic[67] regions of a state. 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

[64] 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.
[65] 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, 2015q).
[66] Ecoregion: "A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables" (USEPA, 2015q).
[67] Physiographic: "The natural, physical form of the landscape" (USEPA, 2015q).

further divided into 182 smaller Level III ecoregions. This Section provides an overview of the terrestrial vegetation resources for Iowa at USEPA Level III (USEPA, 2016b).

As shown in Figure 6.1.6-1, the USEPA divides Iowa into four Level III ecoregions, which closely follow the landscape formed by glacial activity and resultant river valleys and various prairie grassland habitats. Plant communities are influenced heavily by climate in addition to Iowa's geologic past. Tallgrass prairie persists in in western, southern, northeastern, northwestern Iowa, prairie pothole wetlands in central Iowa; maple-oak-elm floodplain forests are prominent in northeastern Iowa and along major rivers and streams; and burr oak forest-prairie savanna and maple-basswood hardwood forests are common in far northeastern Iowa. Table 6.1.6-2 provides a summary of the general abiotic[68] characteristics, vegetative communities, and the typical vegetation found within the four Iowa ecoregions.

In addition to the USEPA ecoregions, geographic regions have been included in Table 6.1.6-2 and will be used in describing Iowa's biological resources in the following sections. Iowa can generally be divided into five geographic regions: Northeast, Northwest, Central, Southeast, and Southwest.

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

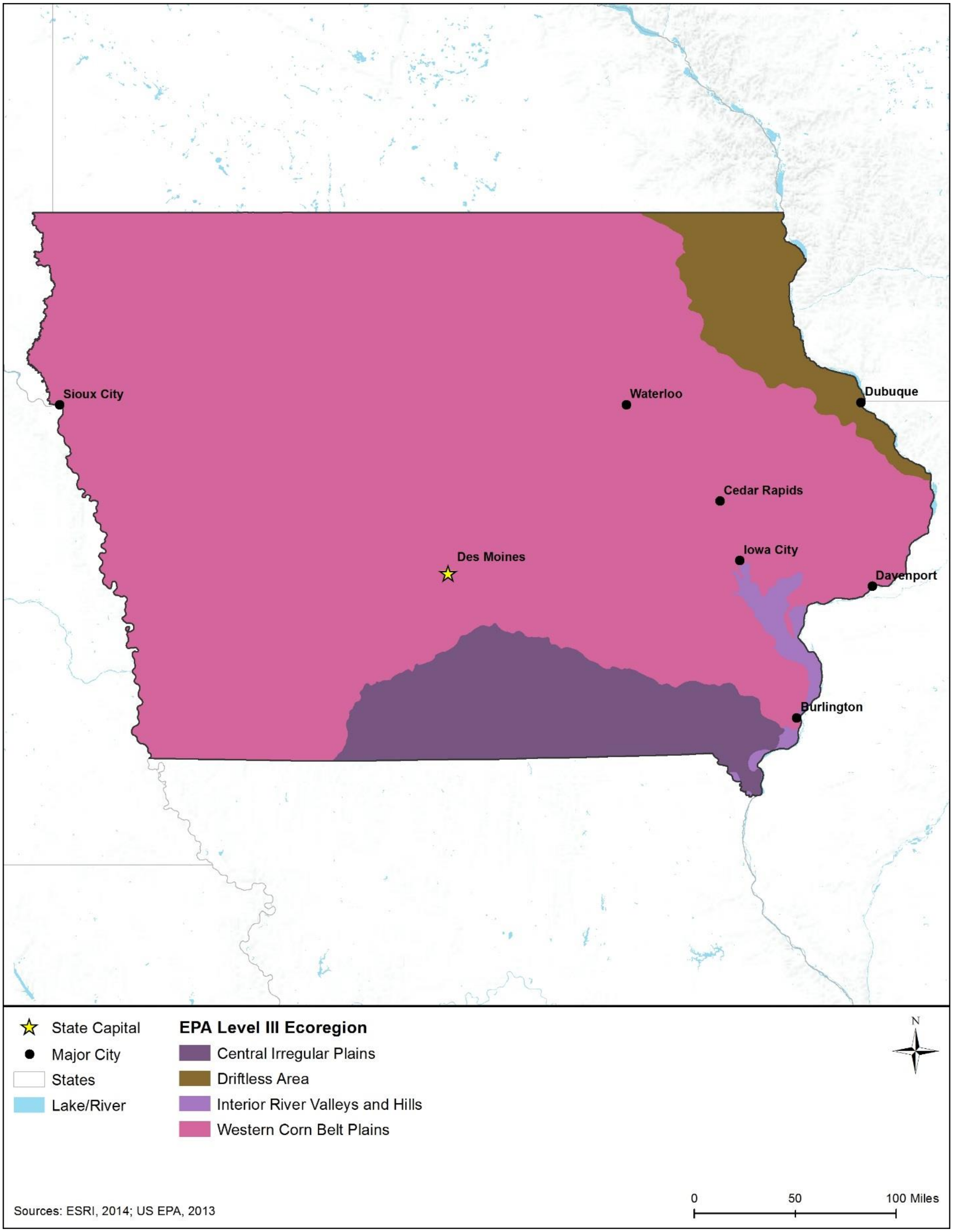


Figure 6.1.6-1: USEPA Level III Ecoregions of Iowa

Table 6.1.6-2: USEPA Level III Ecoregions of Iowa

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
Geographic Regions: Northwest, Southwest, and Central				
47	Western Corn Belt Plains	This region is characterized by nearly level to gently rolling terrain including glaciated till plains and hilly loess plains. Average annual precipitation ranges from 26 to 37 inches occurring mainly during the growing season. Fertile, moist, warm soils have resulted in extensive agricultural activities, including one of the most highly productive areas globally for corn and soybeans.	Historically Tallgrass prairie, Oak savanna and woodlands, northern floodplain forest, Oak forest; currently more than 75% of land is used to support cropland agriculture (corn, soybeans, alfalfa, and other feed grains).	**Deciduous Trees –** Plains cottonwood (*Populus deltoides* ssp. *monilifera*), Green ash (*Fraxinus pennsylvanica*), Boxelder (*Acer negundo*), Elm (*Ulmus* spp.), Hickory (*Carya* spp.), Burr oak (*Quercus macrocarpa*), Basswood (*Tilia americana*), Black walnut (*Juglans nigra*), Willows (*Salix* spp.) **Forbs and Grasses** – Big bluestem (*Andropogon gerardii*), Prairie cordgrass (*Spartina pectinata*), Switch grass (*Panicum virgatum*), Sedges, Indian grass (*Sorghastrum nutans*), Little bluestem (*Schizachyrium scoparium*), Porcupine grass (*Hesperostipa spartea*), Sideoats grama (*Bouteloua curtipendula*), Prairie sandreed (*Calamovilfa longifolia*), Needle and thread (*Hesperostipa comata*)
Geographic Region: Northeast				
52	Driftless Area	This region is hillier than surrounding regions and consists of a loess-topped, bedrock-dominated dissected plateau. Glacial drift was less of an influence on landform in this region than in surrounding areas. Average annual precipitation is approximately 33 inches. Underlying limestone and dolomite rocks result in karst features such as sinkholes, caves, and springs.	Tallgrass prairie, Prairie-oak savanna, Oak forests, Maple-basswood forests	**Deciduous Trees** – Red Oak (*Quercus rubra*), Burr oak (*Q. macrocarpa*), White oak (*Q. alba*), Bitternut hickory (*Carya cordiformis*), Shellbark hickory (*Carya laciniosa*), Sugar maple (*Acer saccharum*), Silver maple (*Acer saccharinum*), Basswood (*Tilia americana*), Elm (*Ulmus* spp.), Cottonwood (*Populus sp.*), River birch (*Betula nigra*), Ash (*Fraxinus sp.*), Willows (*Salix* spp.), Honey locust (*Gleditsia triacanthos*), Hackberry (*Celtis sp.*), Black cherry (*Prunus serotina*) **Forbs and Grasses** – Sideoats grama (*Bouteloua curtipendula*), Big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), Little bluestem (*Schizachyrium scoparium*), Needle and thread (*Hesperostipa comata*), Prairie cordgrass (*Spartina pectinata*), Canada golden rod (*Solidago Canadensis*), sedges (*Carex* spp.)
47	Western Corn Belt Plains	Refer to the earlier overview of Western Corn Belt Plains.	Refer to the earlier overview of Western Corn Belt Plains.	Refer to the earlier overview of Western Corn Belt Plains.
Geographic Region: Southeast Iowa				

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
72	Interior River Valleys and Hills	Many wide, flat-bottomed valleys, glacial plains, and forested valley slopes characterize this ecoregion. This region appears as a transitional area between forested regions to the south and flatter plains and croplands to the north. Average precipitation ranges from 34 to 44 inches per year. A greater proportion of land in this ecoregion remains natural, with fewer acres of cropland and pasture as in surrounding ecoregions.	Cottonwood-willow riparian forest, Pin oak forest, Cordgrass wet prairie, Green ash-elm-hackberry forest, Swamp white oak forest, White-black oak woodland, White oak woodland, Sugar maple-oak forest	**Deciduous Trees** –Willow (Salix spp.), Pin oak (Quercus palustris), White oak (Q. alba), Black oak (Q. velutina), Swamp white oak (Q. bicolor), Red oak (Q. rubra),Pin oak (Quercus palustris), Shagbark hickory (Carya ovata), Bitternut hickory (Carya cordiformis), Yellow poplar (Liriodendron tulipifera), Sugar maple (Acer saccharum), Silver maple (Acer saccharinum, White ash (Fraxinus americana), American elm (Ulmus spp.), Slippery elm (U. rubra) Hackberry (Celtis sp.), Black walnut (Juglans nigra), Cottonwood (Populus spp.), Sycamore (Platanus occidentalis), River birch (Betula nigra) **Shrubs** – Catbrier (*Smilax sp.*), Poison ivy (*Toxicodendron radicans*), Grape (*Vitis* spp.), Coralberry (*Symphoricarpos orbiculatus*), Sumac (*Rhus sp.*) **Forbs and Grasses** – Indian grass (*Sorghastrum nutans*), Little bluestem (*Schizachyrium scoparium*), Prairie cordgrass (*Spartina pectinata*), Big bluestem (*Andropogon gerardii*), Switch grass (*Panicum virgatum*), Sedges, Indian grass (*Sorghastrum nutans*), Sideoats grama (*Bouteloua curtipendula*), Prairie sandreed (*Calamovilfa longifolia*), Needle and thread (*Hesperostipa comata*)
40	Central Irregular Plains	The terrain of this ecoregion is more broken up than the plains to the north but more level and less forested than land to the south and east in Missouri. Portions of this ecoregion were glaciated, resulting in generally rolling to level topography and a variety of soil types. Average annual precipitation ranges from 32 to 40 inches.	Tallgrass prairie, Oak woodlands, Cordgrass wet prairie	**Deciduous Trees –** Bur oak (*Quercus macrocarpa*), White oak (*Quercus alba*), Chinkapin oak (*Q. muehlenbergii*), Plains cottonwood (*Populus deltoides* ssp. *monilifera*), Green ash (*Fraxinus pennsylvanica*), Boxelder (*Acer negundo*), Elm (*Ulmus* spp.) **Forbs and Grasses** – Big bluestem (*Andropogon gerardii*), Prairie cordgrass (*Spartina pectinata*), Sideoats grama (*Bouteloua curtipendula*), Little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), Switch grass (*Panicum virgatum*), Sedges, Needle and thread (*Hesperostipa comata*)
47	Western Corn Belt Plains	Refer to the earlier overview of Western Corn Belt Plains.	Refer to the earlier overview of Western Corn Belt Plains.	Refer to the earlier overview of Western Corn Belt Plains.

Sources: (Chapman et al, 2002) (USEPA, 2015c)

Communities of Concern

Iowa's landscape is one of intensive agricultural use with over 80 percent of the land area used for row crops and other agricultural purposes, with few undisturbed natural plant or wildlife communities remaining (IDNR, 2012) (USDA, 2012). Iowa does not specifically rank vegetative communities of concern such as rare natural plant communities, plant communities with greater vulnerability or sensitivity to disturbance, and communities that provide habitat for rare plant and wildlife species. Rather, vegetation communities were evaluated on a broader sense based upon wildlife habitat. Terrestrial vegetation cover throughout the state is categorized into general land cover type, including agricultural, forest/wooded, developed (e.g., roads, residential, commercial), ungrazed grassland, wetlands, and surface water. These land cover classes were evaluated for the wildlife habitat quality they provide, and three wildlife habitat classes were identified, including wooded, grassland, and wetland habitats. Agricultural fields are generally not considered to provide high quality wildlife habitat. Within the state, southern Iowa has the greatest proportion of wildlife habitats (57 percent), followed by central and northeastern Iowa (33 percent together), with the western, northcentral, and southeastern portions of the state providing the remaining amount (10 percent) of wildlife habitats (IDNR, 2012). During the evaluation of wildlife species of concern, (see Section 6.1.6.4, Terrestrial Wildlife, for further discussion), each wildlife species was assigned to a habitat class or classes based upon habitat use and requirements. In doing so, plant communities were not individually ranked for vulnerability or sensitivity, but rather incorporated into in analyses of wildlife species and wildlife habitats.

Regarding individual plant species, five federally-listed threatened plants are located in Iowa. Section 6.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies and briefly discusses these protected species.

Nuisance and Invasive Plants

There are a large number of undesirable plant species that are considered nuisance and invasive plants. Direct impacts to nuisance and invasive plants may be viewed as beneficial to the environment, but often such impacts result in the inadvertent and unintended spread and dispersal of these species. Construction sites in particular provide colonizing opportunities for 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). 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, 2014a).

Noxious weeds are a threat to Iowa's agricultural lands, waterways, forests, and natural areas. They can have adverse ecological and economic impacts to these resources by displacing and outcompeting plants in both natural ecosystems and managed lands. Iowa has enacted the Iowa Weed Law that regulates the control and destruction of noxious weeds, and most recently updated the noxious weed list in 2014 (Iowa Administrative Code, 2014). The Iowa Department of Agriculture and Land Stewardship (IDALS) is responsible for maintaining the statewide prohibited noxious weed list and updates to that list, as necessary. By state statute, each county may appoint a county weed commissioner to supervise the control and destruction of all noxious weeds in the county.

A total of 24 state-listed noxious weeds are regulated in Iowa (Iowa Administrative Code, 2014). Per the Iowa Weed Law, "each owner and each person in the possession or control of any lands shall cut, burn, or otherwise destroy" all noxious weeds in the manner prescribed by the county board of supervisors. The following 24 noxious weed species by vegetation type are regulated in Iowa:

- **Trees, Shrubs and Vines** – buckthorn (*Rhamnus* spp. [not including *Frangula alnus* syn. *Rhamnus frangula*], multiflora rose (*Rosa multiflora*).
- **Terrestrial Forbs, Grasses, and Grass-like Plants** – butterprint or velvetleaf (*Abutilon theophrasti*), Russian knapweed (*Acroptilon repens*), perennial pepper-grass (*Cardaria draba*), Canada thistle (*Cirsium arvense*) bull thistle (*Cirsium vulgare*), poison hemlock (*Conium maculatum*), European morning glory or bindweed (*Convolvulus arvensis*), wild carrot (*Daucus carota*), teasel (*Dipsacus* spp.) quack grass (*Elymus repens*), leafy spurge (*Euphorbia esula*), wild sunflower (*Helianthus annuus*), buckhorn plantain (*Plantago lanceolata*), smooth dock (*Rumex altissimus*), sheep sorrel (*Rumex acetosella*), sour dock (*Rumex crispus*), wild mustard (*Sinapis arvensis*), horse nettle (*Solanum carolinense*), perennial sow thistle (*Sonchus arvensis*), shattercane (*Sorghum bicolor*), puncturevine (*Tribulus terrestris*), cocklebur (*Xanthium strumarium*).

In addition to the species listed above, all other species of thistle belonging in the genera of *Cirsium* and *Carduus* are regulated noxious weeds in Iowa. Multiflora rose and shattercane are not considered noxious weeds in those counties whose board of supervisors have declared them not to be noxious weeds (Iowa Administrative Code, 2014). None of the Iowa noxious weed species are included on the federal noxious weed list.

6.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in Iowa, divided among mammals,[69] birds,[70] reptiles and amphibians,[71] and invertebrates.[72] Terrestrial wildlife consists of those species, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals, furbearers,[73] nongame animals, reptiles and amphibians, game birds, waterfowl, and migratory birds as well as their habitats within Iowa. 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. Current records indicate Iowa is home to 82 mammal species, 405 bird species, 71 reptile and amphibian species, and a large number of invertebrate species (IDNR, 2012) (Iowa Ornithologists' Union, 2015). A discussion of non-native and/or invasive terrestrial wildlife species is also included within this section.

Iowa has evaluated the wildlife species that occur within the state and identified a subset of Species of Greatest Conservation Need (SGCN). These SGCN are those species considered potentially at-risk of extinction or extirpation from the state or those with low and declining populations. Information from a wide variety of resources was used to establish the SGCN list and is fully discussed in the Iowa State Wildlife Action Plan (SWAP) (IDNR, 2012). A total of 313 SGCN were established in the current SWAP (IDNR, 2012). Establishment of the SGCN list provides the opportunity for groups to receive funding from state wildlife grants for efforts to prevent fish and wildlife populations[74] from becoming endangered. Although these species have been targeted for conservation they are not currently under legal protection. The SGCN list is updated periodically and are used by the state to focus their conservation efforts and as a basis for implementing the SWAP (IDNR, 2012).

Mammals

Common and widespread mammalian species in Iowa include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), cottontail rabbit (*Sylvilagus floridanus*), deer mice, bats, and squirrels. Other species such as beaver (*Castor canadensis*), red fox (*Vulpes vulpes*), opossum (*Didelphis virginiana*), woodchuck (*Marmota monax*), wild turkey (*Meleagris gallopavo silvestris*), pheasant (*Phasianus colchicus*), badger (*Taxidea taxus*), striped skunk (*Mephitis mephitis*), and muskrat (*Ondatra zibethicus*) are also common but less widespread. Most mammal species are widely distributed throughout the state; however, some species such as opossum, and beaver may be more commonly encountered in or along larger

[69] 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, 2015q).
[70] Birds: "Warm-blooded vertebrates possessing feathers and belonging to the class Aves." (USEPA, 2015q).
[71] 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, 2015q).
[72] Invertebrates: "Animals without backbones: e.g., insects, spiders, crayfish, worms, snails, mussels, clams, etc." (USEPA, 2015q).
[73] Furbearer is the name given to mammals that traditionally have been hunted and trapped primarily for fur.
[74] Population: "Aggregate of individuals of a biological species that are geographically isolated from other members of the species and are actually or potentially interbreeding" (USEPA, 2015q).

drainages (rivers and streams) and associated forests, or muskrat, which are associated with wet prairie and prairie pothole habitats in the central and northwestern portion of the state, or bobcat (*Lynx rufus*) which may be limited to the southern and western portions of the state. Iowa is home to 82 mammal species, 19 of which have been identified as SGCN (IDNR, 2012). One threatened and one endangered mammal, the northern long-eared bat (*Myotis septentrionalis*) and Indiana bat (*Myotis sodalis*), respectively, are known to occur in Iowa. Section 6.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, discusses these species.

In Iowa, white-tailed deer are considered big game species. Small game species include small mammals (e.g., rabbits, jackrabbits [*Lepus sp.*], and squirrels), furbearers, and upland and migratory bird species including waterfowl (IDNR, 2012). The following 14 species of furbearers may be legally hunted or trapped in Iowa: coyote, groundhog/woodchuck, raccoon, opossum, red fox, gray fox (*Urocyon cinereoargenteus*), bobcat, muskrat, badger, mink (*Neovison vison*), weasel (*Mustela spp.*), striped skunk, beaver, and otter (*Lontra canadensis*) (IDNR, 2004).

Birds

The number of native bird species documented in Iowa varies according to the timing of the data collection effort, changes in bird taxonomy,[75] and the reporting organization's method for categorizing occurrence and determining native versus non-native status. The diverse ecological communities (i.e., large rivers and lakes, prairies, forests, wetlands, and agricultural lands) found in Iowa support a variety of bird species. Approximately 405 bird species have been documented in Iowa, 210 of which have been documented as nesting within the state (Iowa Ornithologists' Union, 2015). Among the 405 species in Iowa, 66 breeding and 19 migratory species have been identified as SGCN (IDNR, 2012). Three threatened or endangered bird species are known to occur in Iowa and are discussed in Section 6.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Iowa is located within the Mississippi Flyway, which spans the Great Lakes watershed, Mississippi River valley, and the Gulf Coast. The Central Flyway extends from north-central Canada south to the Gulf Coast. The Mississippi Flyway generally follows the Mississippi River valley and Mississippi River delta in the United States (National Audubon Society, 2015a). 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, 2013). The USFWS is responsible for enforcing the MBTA and maintaining the list of protected species. The migratory bird species protected under the MBTA are listed in 50 CFR 10.13 (USFWS, 2013).

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

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act. Bald eagles migrate south to Iowa from northern states and Canada in the winter (IDNR, 2010b). Bald eagles tend to concentrate along the Mississippi River, but are commonly found near large rivers and lakes throughout the state. Golden eagles are found in a variety of habitats within their range, but they generally nest in mountains and cliffs. Golden eagles have been found in northeastern Iowa during the winter season (Mehus and Martell, 2010) (National Eagle Center, 2015).

Ninety-four Important Bird Areas (IBAs) have also been identified in Iowa. The IBA program is an international bird conservation initiative with a goal of identifying the most important places for birds, and to conserve these areas. These IBAs are identified according to standardized, scientific criteria through a collaborative effort among state, national, and international conservation-oriented non-governmental organizations (NGOs), state and federal government agencies, local conservation groups, academics, grassroots environmentalists, and birders. These IBAs link global and continental bird conservation priorities to local sites that provide critical habitat for native bird populations (National Audubon Society, 2015b).

According to the Iowa Audubon Society, a total of 94 IBAs have been identified in Iowa, including breeding,[76] migratory stop-over, wintering areas, feeding areas, and a variety of habitats and wintering rounds (Iowa Audubon Society, 2015). These IBAs are widely distributed throughout the state, although the largest concentration of IBAs are located along the Missouri, Raccoon, Des Moines, Skunk, Iowa, Cedar, Little Sioux, and Wapsipinicon rivers throughout the state as displayed in Figure 6.1.6-2.

Reptiles and Amphibians

A total of 71 reptile and amphibian species, such as turtles, snakes, and salamanders, occur in Iowa. Of these species are 5 salamanders, 17 frogs, 13 turtles including the spiny softshell turtle (*Apalone spinifera*), 5 lizards, and 31 snakes (IDNR, 2012). These species occur in a wide variety of habitats across the state, with some having widespread distribution and others being limited to a smaller region or locations in the state. Iowa's frogs and turtles are regulated under game law and may be taken or used for bait or food purposes (Iowa Administrative Code, 2009). Of the 71 reptile and amphibian species, 32 SGCN have been identified. One species, the eastern massasauga rattlesnake (*Sistrurus catenatus*), is a candidate for federal listing on the Endangered Species Act, and is discussed in Section 6.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

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

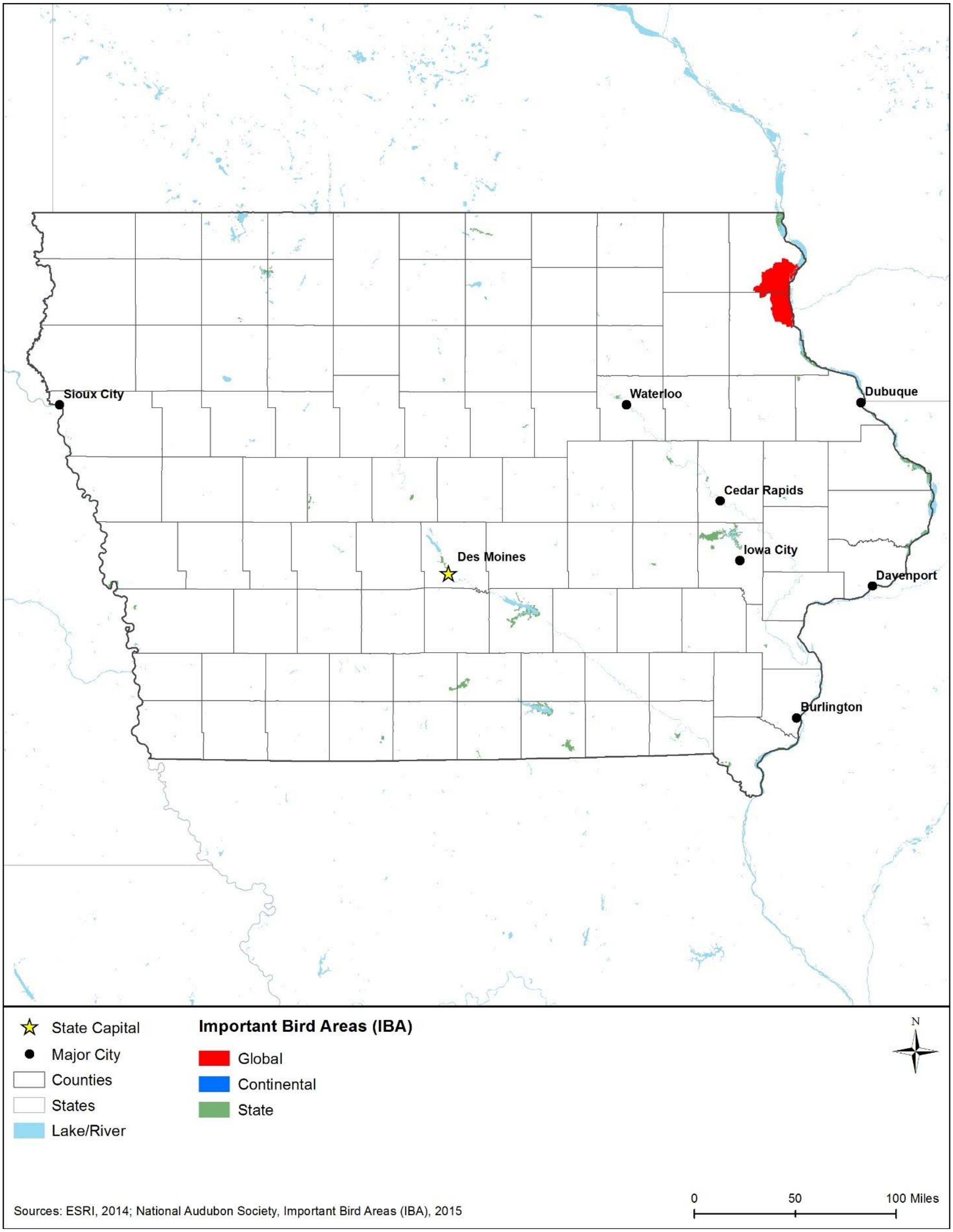


Figure 6.1.6-2: Important Bird Areas in Iowa

Invertebrates

The total number of invertebrate species occurring in Iowa is unknown but includes at least approximately 106 species of dragonflies and damselflies, approximately 119 species of butterflies, and a wide variety of moths, mayflies, ants, beetles, land snails, and other invertebrate species. These invertebrates provide an abundant food source for birds, reptiles, amphibians, fish, mammals, and other invertebrates. In the United States, one third of all agricultural output depends on pollinators.[77] In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity[78] and plant diversity. "As a group, native pollinators are threatened by habitat loss, pesticides, disease, and parasites" (NRCS, 2009). Life history, distribution, and abundance information is limited to a small number of Iowa's invertebrates. Given this lack of information on invertebrate species within the state, Iowa has chosen to focus identification of at-risk species and species groups for which adequate information is available, resulting in a total of 73 terrestrial SGCN, including 37 butterflies, 28 dragonflies and damselflies, and 8 land snails (IDNR, 2012). Six endangered invertebrate species, three of which are terrestrial and three are aquatic, are known to occur in Iowa, and are discussed in Section 6.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invasive Wildlife Species

The IDALS addresses invasive species of all types, including noxious weeds as previously mentioned. Two invasive insect species are known to occur in Iowa, the emerald ash borer (*Agrilus planipennis*) and gypsy moth (*Lymantria dispar*). The Asian longhorned beetle (*Anoplophora glabripennis*) and the thousand cankers disease on black walnut are on a watchlist for Iowa as they have not yet been detected but the potential exists for them to occur (IDALS, 2015a). Aquatic invasive species are addressed in Section 6.1.6.5, Fisheries and Aquatic Habitat.

The link between nonnative forest insect and disease infestations and firewood as a major source of these infestations has been widely recognized. The IDALS has enacted a statewide quarantine for the emerald ash borer on firewood unless it has been properly treated. In addition to emerald ash borer, firewood may harbor various invasive pests and diseases, including Asian longhorned beetle, gypsy moth, oak wilt, and sirex woodwasp (IDALS, 2015a). It is for these reasons that officials urge using local firewood and not transporting firewood across state or county lines unless it has been properly treated.

6.1.6.5. Fisheries and Aquatic Habitat

This section discusses the aquatic wildlife species in Iowa, including freshwater fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented. Fish in Iowa are commonly split in two groups – coldwater species and coolwater/warmwater species, reflecting the general aquatic habitats in which fish occur. Iowa contains a variety of aquatic

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[77] Pollinators: "Animals or insects that transfer pollen from plant to plant." (USEPA, 2015q).
[78] Diversity: "An ecological measure of the variety of organisms present in a habitat." (USEPA, 2015q).

habitats, and all rivers and streams in Iowa are part of either the Mississippi River watershed (69 percent of Iowa's surface area) or the Missouri River watershed (31 percent of Iowa's surface area) (IDNR, 2012). In addition to these larger rivers (e.g., Mississippi, Missouri, Cedar, Raccoon, Des Moines), many ponds exist in southern Iowa, coldwater streams are located primarily in northeastern Iowa, natural lakes are most common in the northwestern and central regions in Iowa, and constructed lakes occur throughout the state, primarily associated with farms and dams along rivers and streams. No Essential Fish Habitat (EFH) identified by the Magnuson-Stevens Fishery Conservation and Management Act exists in Iowa. Two endangered fish species exist in Iowa and are addressed in Section 6.1.6.6, Threatened and Endangered Species and Species of Conservation Concern. Critical habitat, as defined by the ESA, exists within Iowa for the Topeka Shiner *(Notropis topeka)* and is discussed in Section 6.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Freshwater Fish

Iowa is home to 153 species of freshwater fish (IDNR, 2012), ranging in size from small minnows to medium sized species such as walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), and striped bass (*Morone saxatilis*). These species are grouped into 26 families, as follows: basses, bowfins, carps and minnows, catfishes, cods, drums and croakers, freshwater eels, gars, herrings, lampreys, livebearers, mooneyes, mudminnows, paddlefishes, perches, pikes, pirate perches, sculpins, silversides, sticklebacks, sturgeons, suckers, sunfishes, trouts/salmons, topminnows, and trout-perches (IDNR, 2012). Among these species are numerous recreational and game fish, such as northern pike (*Esox lucius*), yellow perch, walleye, muskellunge (*Esox masquinongy*), catfish, sunfishes, bass, and trout. Of the 153 species in Iowa, 75 SGCN have been identified (IDNR, 2012). Two endangered fish species, pallid sturgeon (*Scaphirhynchus albus*) and Topeka shiner (*Notropis topeka*), are known to occur in Iowa and are discussed in Section 6.1.6.6, Threatened and Endangered Species (DNR, 2011).

Fish communities in Iowa follow a roughly defined distribution between two general habitat types: habitats adjacent to and including large rivers or deep lakes and reservoirs, and those of smaller streams or shallow lakes and ponds. Large rivers or deeper aquatic habitat fish species include largemouth bass (*Micropterus salmoides*), northern pike, American eel (*Anguilla rostrata*), burbot (*Lota lota*), and paddlefish (*Polyodon spathula*), among others. Small streams or shallow aquatic habitat fish species include chub and minnows, bluegill (*Lepomis macrochirus*), brook trout (*Salvelinus fontinalis*), yellow perch, smallmouth bass (*Micropterus dolomieu*), brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), and sculpins (*Cottus spp*.). Some fish species use both habitat types (e.g., yellow perch, walleye, carp, suckers), but many tend to occur in one of the two general habitat types (Iowa Association of Naturalists, 2016)

Freshwater fish and associated freshwater habitats are considered one of the most highly threatened ecosystems based on the vast decline in species population numbers. Approximately 40 percent of fish species in North America are considered at risk or vulnerable to extinction[79]

[79] Extinction: "The disappearance of a species from part or all of its range." (USEPA, 2015q).

(National Fish Habitat Board, 2010) (USFWS, 2015v). Major threats to freshwater fisheries include habitat modification and destruction (dams, culverts, weirs, urban development, and agricultural practices), overfishing, invasive species, and environmental pollution and impaired water quality. Among freshwater fish in Iowa and other central Midwest states in general, agricultural row crops and pasture farming are the primary threats to habitat. Two species, pallid sturgeon (*Scaphirhynchus albus*) and Topeka shiner (*Notropis topeka*), are among those that have been most impacted by human activities in the region. The extensive amount of agricultural and pasture farming in the state result in large amounts of runoff and drainage from fields and feed lots that tend to be high in organic nutrients and sediments which degrade water quality. Habitat modification and degradation from dam construction and agricultural activities have also resulted in changes to stream hydrology and temperature and streamside habitat, and in conjunction with agricultural runoff have resulted in population declines of these and other species (National Fish Habitat Board, 2010).

Shellfish and Other Invertebrates

A complete inventory of freshwater mollusks and crustaceans has not been completed for Iowa. Species that are known to occur in Iowa include freshwater snails, sandshells, ambersnails, and mussels. Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), other Iowa freshwater invertebrates that spend their lives in aquatic systems include crayfish and amphipods.

Iowa has established 29 mollusk SGCN in the state (IDNR, 2012). Three endangered mussel species are located in Iowa and are discussed in Section 6.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invasive Aquatic Species

As previously discussed, Iowa has adopted regulations that prohibit or regulate the importation, movement, sale, possession, cultivation, and distribution of certain invasive plants and animals. In addition, Iowa has established an aquatic invasive species program to prevent the introduction of invasive species, promote early detection and response to control new infestations, and reduce the impact of aquatic invasive species (Iowa Administrative Code, 2008). The IDNR has established lists of aquatic invasive species in the following three categories (Iowa Administrative Code, 2008).

- **Aquatic invasive plants** – flowering rush (*Butomus umbellatus*), purple loosestrife (*Lythrum salicaria, Lythrum virgatum*), brittle naiad (*Najas minor*), Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), and salt cedar (*Tamarix spp*.).
- **Aquatic invasive fish** – ruffe (*Gymnocephalus cernuus*), silver carp (*Hypophthalmichthys molitrix*), bighead carp (*Hypophthalmichthys nobilis*), white perch (*Morone americana*), black carp (*Mylopharyngodon piceus*), round goby (*Neogobius melanostomus*), and rudd (*Scardinius erythrophthalmus*).

- **Aquatic invasive invertebrates** – rusty crayfish (*Bythotrephes cederstroemi*), fishhook waterflea (*Cercopagis pengoi*), quagga mussel (*Dreissena bugensis*), zebra mussel (*Dreissena polymorpha*), and New Zealand mudsnail (*Potamopyrgus antipodarum*).

6.1.6.6. Threatened and Endangered Species and Species of Conservation Concern

The USFWS is responsible for administering the ESA (16 U.S.C §1531 et seq.) in Iowa. The USFWS has identified nine federally endangered and eight federally threatened species known to occur in Iowa (USFWS, 2015c). Of these 7 federally listed species, 2 have designated critical habitat[80] (Figure 6.1.6-3) (USFWS, 2015d). The 17 federally listed species include 2 mammals, 2 birds, 2 fish, 6 invertebrates, and 5 plants, and are discussed in detail under the following sections (USFWS, 2015c). 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

One endangered and one threatened mammal species are federally listed for Iowa as summarized in Table 6.1.6-3. The Indiana bat *(Myotis sodalis)* occurs in the southern half of Iowa. The Northern Long-eared bat *(Myotis septentrionalis)* occurs throughout Iowa. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Iowa is provided below.

Table 6.1.6-3*: Federally Listed Mammal Species of Iowa*

Common Name	Scientific Name	Federal Status	Critical Habitat in Iowa	Habitat Description
Indiana Bat	*Myotis sodalis*	Endangered	No	Trees and snags, caves, and abandoned mines; found in 38 counties in the southern half of Iowa.
Northern Long-eared Bat	*Myotis septentrionalis*	Threatened	No	Trees and snags, caves, and abandoned mines; found in 99 counties throughout Iowa.

Source: (USFWS, 2015c)

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

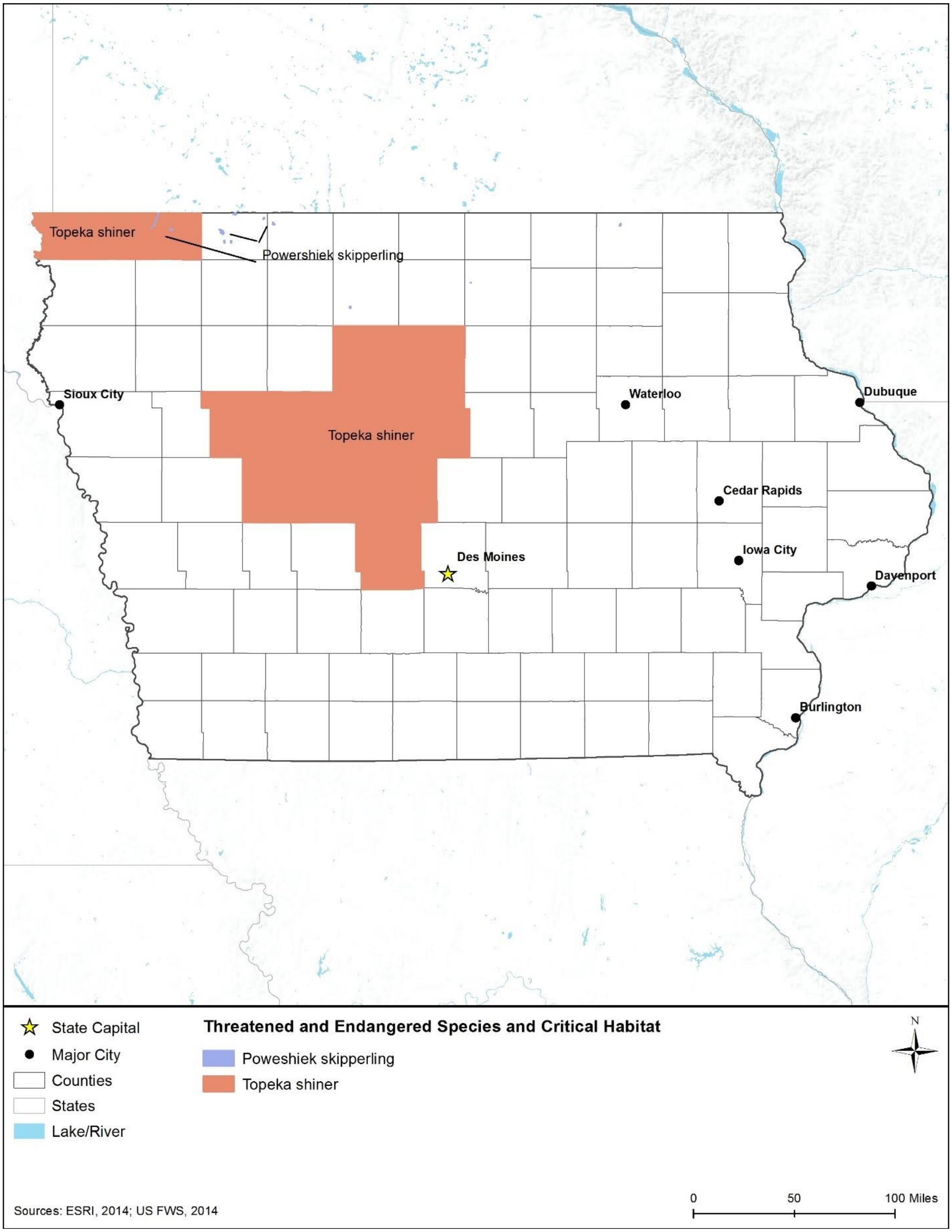


Figure 6.1.6-3: ESA Designated Critical Habitat in Iowa

Indiana Bat Photo credit: USFWS

Indiana Bat. The Indiana bat is an insectivorous mammal approximately 1.5 to 2 inches in length with a wingspan of 9 to 11 inches. The bats have dull grayish chestnut fur and resemble the common little brown bat (*Myotis lucifugus)* (USFWS, 2015ad) (USFWS, 2015ae). The Indiana bat was originally federally listed as "in danger of extinction" under early endangered species legislation 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.). In 2015, only 523,636 Indiana bats were known to exist in the species range (USFWS, 2015u). Regionally, this species is currently found in the central portion of the eastern United States, including parts of Iowa and Missouri (USFWS, 2015ae). In Iowa, the Indiana bat is known to occur in 38 counties in the southern half of the state (USFWS, 2015ad) (USFWS, 2015ae).

In the fall, the Indiana bats migrate to their hibernation sites in caves and abandoned mines in order to mate and build up fat reserves for hibernation season in the winter. Upon emerging from hibernation, the bats feed near their hibernations sites before migrating to their summer habitats, where the females roost. Summer habitats and hibernation areas can be 300 miles apart (USFWS, 2004a). Indiana bats roost in trees during the day and feed at night in a variety of habitats, although streams, floodplain forests, ponds, and reservoirs are preferred. Females roost together in maternity colonies under the loose bark of dead or dying trees, or under the loose bark of shaggy-barked trees, although the physical characteristics of individual trees appear to be more of a factor than the species of tree. Tree species that have been noted as preferred by Indiana bat include shagbark hickory (*Carya ovata*), white oak (*Quercus alba*), silver maple (*Acer saccharinum*), sugar maple (*Acer saccharum*), green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoides*), and American elm (*Ulmus rubra*) (USFWS, 2012a).

Threats to this species include disturbance and intentional killing of hibernating and maternity colonies, disturbances to air flow in caves from the improper installation of security gates, habitat fragmentation and degradation, the use of pesticides or other environmental contaminants, and White Nose Syndrome (USFWS, 2004a) (USFWS, 2015ae). White Nose Syndrome is a rapidly spreading fungal disease that afflicts hibernating bats (USGS-NWHC, 2015).

Northern Long-eared Bat. The threatened northern long-eared bat is a brown furred, insectivorous bat with long ears. This bat is medium-sized, relative to other members of the genus *Myotis*, reaching a total length of 3 to 3.7 inches in length (USFWS, 2015e). The northern long-eared bat was listed as endangered in 2013 (78 FR 72058, December 2, 2013) and was relisted as threatened in 2015 (80 FR 17973, April 2, 2015). In the United States, its range includes most of the eastern and north central states. In Iowa, the northern long-eared bat is known to occur in 99 counties throughout the state (USFWS, 2015c) (USFWS, 2015e).

The northern long-eared bat hibernates in caves and mines, which have constant temperatures, high humidity, and no air currents. In the summer, individuals roost singly or in colonies beneath bark, or in crevices or cracks of both live and dead trees. Although mating occurs in the fall, fertilization occurs following hibernation, from which pregnant females then migrate to summer areas where they roost in small colonies (USFWS, 2015e).

White Nose Syndrome is the leading cause for the decline of this species. The numbers of northern long-eared bats in hibernacula has decreased by 99 percent in the northeast United States; the syndrome is confirmed in Jackson, Clayton, and Webster Counties and suspected in Jasper and Dubuque Counties (USGS-NWHC, 2015) (USFWS, 2015e). Other threats include temperature or air flow impacts to their hibernating habitat, forest management practices that are incompatible with this species' habitat needs, habitat fragmentation, and wind farm operations (USFWS, 2015e).

Birds

One endangered and one threatened bird species are federally listed for Iowa as summarized in Table 6.1.6-4. The Least Tern *(Sterna antillarum)* and the Piping Plover *(Charadrius melodus)* occur in central and western Iowa. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Iowa is provided below.

Table 6.1.6-4: Federally Listed Bird Species of Iowa

Common Name	Scientific Name	Federal Status	Critical Habitat in Iowa	Habitat Description
Least Tern	*Sterna antillarum*	Endangered	No	Unvegetated sandbars near rivers, reservoirs and other open water habitat. Found in Polk, Pottawattamie, and Woodbury counties, in western and central Iowa.
Piping Plover	*Charadrius melodus*	Threatened	No	Open, sparsely vegetated beaches composed of sand or gravel on islands or shorelines of inland lakes or rivers. Found in Pottawattamie and Woodbury counties.

Source: (USFWS, 2015c)

Least Tern. The least tern is a small gray and white shorebird, with black streaking on its head, forked tail, and narrow pointed wings. Adult birds are approximately 9 inches in length. Juveniles have less distinctive black streaking on the head and less of a forked tail. Unlike gulls, least terns will dive into the water for small fish (USFWS, 2015f).

Least Tern Photo credit: USFWS

Least terns occur in 18 U.S. states and were listed as endangered in 1985 (50 FR 21784, May 28, 1985). In Iowa, the species is known to occur in Polk, Pottawattamie, and Woodbury Counties, in the western and central parts of the state (USFWS, 2015c) (USFWS, 2015f).

Habitat for least terns in Iowa is relatively unvegetated sandbars near rivers, reservoirs, and other open water habitat. The primary threat to this species is the destruction and degradation of habitat. Nest disturbance and predation can also be factors. The primary causes of habitat loss historically have been dam construction, recreational activities, and the alteration of flow regimes along major river systems (Iowa Department of Agriculture and Land Stewardship, 2016) (USFWS, 2015f).

Piping Plover. The piping plover is a small, sand-colored migratory shorebird; it is approximately 6.5 to 7 inches in length with a wingspan up to 19 inches and weighs between 1.5 to 2.3 ounces. It was first listed as endangered in 1985 for the Great Lakes watershed of both the U.S. and Canada, and as threatened in the remainder of its range in the U.S. (50 FR 50726, December 11, 1985). Regionally, the piping plover occurs in the Northern Great Plains, along the Atlantic Coast, and in the Great Lakes Area within the U.S. (USFWS, 2001). In Iowa, it can be found in Pottawattamie and Woodbury counties, in the western part of the state (USFWS, 2015g) (USFWS, 2001).

This species feeds in the shorelines of coastal ponds, lagoons, and salt marshes. They feed on worms, fly larvae, beetles, crustaceans, and other marine macroinvertebrates, (USFWS, 2001). The preferred habitat is wide, open, sandy beaches with little vegetation. This species nests in small creeks or wetlands and create shallow nest lined with pebbles or broken shells. The female would lay an average of two to four eggs and both female and male care for them until eggs hatch (USFWS, 2001). Piping plovers breed in three geographic regions of North America, composed of two separate subspecies. Those breeding on the Atlantic Coast of the U.S. and Canada are of the subspecies *C. m. melodus*, whereas the other subspecies, *C. m. circumcinctus*, includes two distinct populations, one which breeds on the Northern Great Plains of the U.S. and Canada, and the other which breeds on the Great Lakes (USFWS, 2015g). Piping plovers use sites throughout Iowa as stopover and nesting habitat. Piping plovers migrate from the Northern Great Plains, Northern Atlantic Coast, and Great Lakes Area to the coastal habitats in the south (IDALS, 2015b). Current threats to this species include habitat loss and degradation, human disturbance, pets, predation, and environmental contaminants (USFWS, 2003) (USFWS, 2001).

Fish

Two endangered fish species are federally listed for Iowa as summarized in Table 6.1.6-5. The Pallid Sturgeon *(Scaphirhynchus albus)* occurs along the western border of Iowa. The Topeka Shiner *(Notropis topeka)* occurs throughout central Iowa. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Iowa is provided below.

Table 6.1.6-5: Federally Listed Fish Species of Iowa

Common Name	Scientific Name	Federal Status	Critical Habitat in Iowa	Habitat Description
Pallid Sturgeon	*Scaphirhynchus albus*	Endangered	No	Large rivers with strong currents. Found in six counties along the western border of Iowa.
Topeka Shiner	*Notropis topeka*	Endangered	Yes; Raccoon River Watershed, Boone River Watershed, Rock River Watershed	Small prairie streams in pools containing clear, clean water, clean gravel, rock, or sand bottoms. Found in 13 counties in central Iowa.

Sources: (USFWS, 2015c) (USFWS, 2015d)

Pallid Sturgeon Photo credit: USFWS

Pallid Sturgeon. The pallid sturgeon is one of largest fish found east of the Continental Divide and known to occur in the lower Mississippi and Missouri Rivers with a maximum weight of over 80 pounds (IDALS, 2016a). The pallid sturgeon has a flattened snout and the part of the body just before the tail (caudal peduncle) is armored with cartilage plates (USFWS, 2014b) (USFWS, 2015h). This species was first federally listed as endangered in 1990 (55 FR 36641, September 6, 1990). The pallid sturgeon is found in the Missouri River and ranges from Montana through the Missouri-Mississippi confluence and down to New Orleans, Louisiana. In Iowa, pallid sturgeon are found in six counties along the western border of the state (USFWS, 2015c) (USFWS, 2015h) (USFWS, 2014b).

Pallid sturgeons prefer large rivers with strong currents; they can withstand a wide range of turbidity conditions. The key reason for this species' decline has been habitat fragmentation and alteration from the damming of major rivers and other large tributaries (USFWS, 2014b) (IDALS, 2016a).

Topeka Shiner. The Topeka shiner is a silvery minnow with a dark stripe on its side growing to approximately 3 inches in length (USFWS, 2016d). The species was federally listed as endangered in 1998 (63 FR 69008 69021, December 15, 1998) with critical habitat designated in 2004 (69 FR 44736 44770, July 27, 2004) in the Raccoon River Watershed, Boone River Watershed, and Rock River Watershed, Iowa (Figure 6.1.6-3). The Topeka shiner is known to occur in portions of South Dakota, Minnesota, Kansas, Iowa, Missouri, and Nebraska. In Iowa, it can be found in 13 counties in the central portion of the state (IDALS, 2016b).

The Topeka shiner occurs primarily along small prairie streams in pools containing clear, clean water, clean gravel, rock, or sand bottoms. Threats to the species include alterations to stream quality such as increases in sedimentation or nutrients from fertilizers, changes in stream flow volume or temperatures, and restricted access for species river movement and isolation of populations (USFWS, 2015i) (IDALS, 2016b).

Invertebrates

Five endangered and one threatened invertebrate species are federally listed for Iowa as summarized in Table 6.1.6-6. The Dakota Skipper (*Hesperia dacotae*) and the Poweshiek Skipperling (*Oarisma poweshiek*) occur in central and northern Iowa. The Iowa Pleistocene Snail *(Discus macclintocki)* and the Spectaclecase Mussel (*Cumberlandia monodonta)* occur in eastern Iowa. The Sheepnose Mussel (*Plethobasus cyphyus*) occurs in northern, central, and southeastern parts of the states. The Higgins Eye Pearlymussel (*Lampsilis higginsii*) occurs in southeastern Iowa. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Iowa is provided below.

Table 6.1.6-6: Federally Listed Invertebrate Species of Iowa

Common Name	Scientific Name	Federal Status	Critical Habitat in Iowa	Habitat Description
Dakota Skipper	*Hesperia dacotae*	Threatened	No	In moist bluestem prairie and upland prairie that is somewhat dry and usually found on ridges and hillsides. Found in Dickinson County in northern Iowa.
Higgins Eye Pearlymussel	*Lampsilis higginsii*	Endangered	No	Deep, moderately flowing rivers with firm, loose riverbeds. Found in 12 counties in southeastern Iowa.
Iowa Pleistocene Snail	*Discus macclintocki*	Endangered	No	Leaf litter of algific talus slopes.[81] Found in 5 counties in eastern Iowa.
Poweshiek Skipperling	*Oarisma poweshiek*	Endangered	Yes; 11 units in Cerro Gordo, Dickinson, Emmet, Howard, Kossuth, and Osceola counties	Prairie fens and tallgrass; found in 7 counties in northern Iowa.
Sheepnose Mussel	*Plethobasus cyphyus*	Endangered	No	Large rivers and streams with moderate to swift currents and shallow shoal habitats. Found in 13 counties mostly along the eastern border of Iowa, and in central and northern Iowa.
Spectaclecase Mussel	*Cumberlandia monodonta*	Endangered	No	Sheltered areas in large rivers; found in 7 counties along the eastern border of Iowa.

Source: (USFWS, 2015w)

[81] Talus slopes are a very rare, fragile ecosystem and habitat stated to exist only in the Driftless Area of Minnesota, Wisconsin, Illinois, and especially, Iowa.

Dakota Skipper. The Dakota skipper is a small butterfly with a wingspan of one inch. It has a thick body and flies faster and more powerfully than most butterflies. Males have tawny-orange to brown colored upper wings with a mark on the forewing, and a dusty yellow-orange lower surface. Females have darker brown colored upper wings with tawny-orange spots and some white spots on the edge of the forewing, and a gray-brown colored lower surface with a faint white spot across the middle (USFWS, 2015x). The Dakota skipper was federally listed as threatened in 2014 (79 FR 63671, October 24, 2014).

Regionally, this species is known or believed to occur in Iowa, Minnesota, North Dakota, and South Dakota. In Iowa, it can be found in Dickinson County, in the northern portion of the state (USFWS, 2015j) inhabiting two types of prairies; moist bluestem prairie and upland prairie that are somewhat dry and usually found on ridges and hillsides. The biggest threat to the Dakota skipper is habitat loss and degradation due to overgrazing and land conversion (USFWS, 2015x).

Higgins Eye (Pearlymussel). The Higgins' eye pearlymussel is a larger river mussel species which was listed as endangered in 1976 (41 FR 24062, June 14, 1976) (USFWS, 2004b). The species' range is primarily limited to the northern third of the Mississippi tributaries from between Louisiana and Indiana to between Minnesota and Wisconsin. Within Iowa, it can be found in 12 counties in the southeastern part of the state (USFWS, 2004b) (USFWS, 2015c) (USFWS, 2015l).

The species is usually found in mussel beds with at least 15 other types of mussels, in portions of rivers with firm, loose bottoms such as sand and gravel, and not clay or concrete. The river environment should be deep with a moderate flow. The primary limiting factor to the Higgins' eye pearlymussel is the threat of invasive species such as the Zebra mussel, which has intensively impacted mussel communities in various locations throughout the species' range (USFWS, 2004b).

Iowa Pleistocene Snail. The Iowa Pleistocene snail is brown or greenish-white in color and measures about 0.2 inches across its shell (USFWS, 2015m) (USFWS, 2015n). It was listed as endangered in 1978 (43 FR 28930, August 2, 1978). Fossils reveal that the Iowa Pleistocene snail's geographic extent was more wide-spread during glacial periods (USFWS, 2015m) (USFWS, 2015n). It is now found at about 30 sites in Iowa and Illinois, and occurs in five counties in Iowa (USFWS, 2015c) (USFWS, 2015m). The Iowa Pleistocene snail has very specific temperature and moisture requirements that make its habitat rare; they exist only on botanically diverse, undisturbed, algific[82] talus slopes (USFWS, 1984).

The biggest threat to this species is climate change and subsequent alteration of the specific habitat conditions this snail requires. This snail is also threatened by loss of its natural habitat and misapplication of pesticides (USFWS, 2015m) (USFWS, 2015n).

[82] Talus slopes are a very rare, fragile ecosystem and habitat stated to exist only in the Driftless Area of Minnesota, Wisconsin, Illinois, and especially, Iowa.

Poweshiek Skipperling. The Poweshiek skipperling is a small, dark brown and orange butterfly with streaked, white veins on the underside of its wings (USFWS, 2014c). The species was listed as endangered in 2014 (79 FR 63671, October 24, 2014). The range for the Poweshiek skipperling has historically extended from Canada to Iowa, however has been reduced to the eastern regions of North and South Dakota to the eastern edge of Michigan. Further, 2014 surveys have only found single populations within Michigan, Wisconsin, and central Canada and although it is possible that the species may no longer occur in Iowa, its current range could include parts of five counties in the state (USFWS, 2014c) (USFWS, 2016a).

Critical habitat was designated in 2015 (80 FR 59247, October 1, 2015) at 11 units in Cerro Gordo, Dickinson, Emmet, Howard, Kossuth, and Osceola Counties, Iowa, although all units are currently considered to be unoccupied (Figure 6.1.6-3) (USFWS, 2015k). Habitat for the Poweshiek skipperling consists of high-quality prairie tallgrass and moist prairie fens, feeding on prairie flower nectar and utilizing sedges for larvae development. Habitat loss and habitat fragmentation are the primary reasons for the species' decline, and remain as current threats to the species' survival. Incompatible grazing or controlled burning techniques pose significant threats to the species' habitat health (USFWS, 2014c).

Sheepnose Mussel. The sheepnose mussel is a medium sized freshwater mussel that usually grows about 5 inches. The sheepnose shell is a light yellow to dull yellowish brown color with darker ridges (USFWS, 2012c). After multiple reviews since 2004, the USFWS listed the sheepnose mussel as endangered in 2012 (77 FR 14914, March 13, 2012). This species historically occurred mostly along the Mississippi River, and populations can now be found in Alabama, Illinois, Indiana, Iowa, Kentucky, Minnesota, Missouri, Ohio, Pennsylvania, Virginia, West Virginia, and Wisconsin (USFWS, 2012c). In Iowa, it can be found in 8 counties mostly along the eastern border of the state, but with populations in central and northern portions as well (USFWS, 2015c) (USFWS, 2015o) (USFWS, 2016b).

Sheepnose mussels are known to occur in large rivers and streams with moderate to swift currents and feed on suspended algae, bacteria, detritus, and microscopic animals. This species prefers shallow shoal habitats above coarse sand and gravel. For reproduction, the sheepnose prefers a stable undisturbed habitat with the presence of sauger (*Sander canadensis*), its only host fish. Threats include sedimentation, dams that restrict natural flow, habitat reduction, water quality degradation, contaminations of nutrients, and invasive species of zebra mussels (*Dreissena polymorpha*) (USFWS, 2012c).

Spectaclecase (Mussel). The spectaclecase mussel (*Cumberlandia monodonta*) is a large (up to 9 inches long) freshwater mussel. Its brownish to black shell has a somewhat curved appearance and moderate inflation (USFWS, 2012b). This species was first listed as federally endangered in 2012 (77 FR 14914, April 12, 2012). Today the spectaclecase mussel has suffered a 55 percent decrease in distribution and only occurs in 20 of the 44 streams it once inhabited. Most populations are now fragmented and limited to short reaches of streams in the 12 states in which it occurs: Alabama, Arkansas, Illinois, Iowa, Kansas, Kentucky, Minnesota, Missouri, Tennessee, Virginia, West Virginia, and Wisconsin (USFWS, 2012b) (USFWS, 2015p). In Iowa, it can be found in seven counties along the eastern border of the state (USFWS, 2015p).

Suitable habitat for the spectaclecase mussel includes sheltered areas in large rivers. This species seeks out areas that are sheltered from the force of the river current such as beneath rock slabs, firm mud banks, and in-between tree roots. Spectaclecase mussels spend their entire lives partially or completely buried in river bottom substrate, and some specimens have been recorded up to 70 years old. This species of mussels have a complex reproduction cycle, they have a parasitic life stage and are dependent on a host fish for successful rearing and relocation of larvae young. The current major threats to the survival of this species are dams. Dams alter the natural flow and temperature regime of rivers, blocking fish passage which are necessary to prevent fragmentation and connect populations. Sedimentation of rivers, pollution, channelization, and invasive zebra mussels also pose threats to this species (USFWS, 2012b).

Plants

Five threatened plant species are federally listed for Iowa as summarized in Table 6.1.6-7. The northern wild monkshood *(Aconitum noveboracense)* occurs in northeastern and central Iowa. The Eastern Prairie Fringed Orchid *(Platanthera leucophaea)* occurs in eastern and southern Iowa. The Mead's Milkweed *(Asclepias meadii)* occurs in southern Iowa. The Prairie Bush-clover (*Lespedeza leptostachya*) and the Western Prairie Fringed Orchid (*Platanthera praeclara*) occur throughout Iowa. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Iowa is provided below.

Table 6.1.6-7: Federally Listed Plant Species of Iowa

Common Name	Scientific Name	Federal Status	Critical Habitat in Iowa	Habitat Description
Eastern Prairie Fringed Orchid	*Platanthera leucophaea*	Threatened	No	Wetlands and prairies with full sunlight; found in Decatur, Jackson, Johnson, and Jones counties in eastern and southern Iowa.
Mead's Milkweed	*Asclepias meadii*	Threatened	No	Grasslands and stable prairie habitats. Found in five counties in southern Iowa.
Northern Wild Monkshood	*Aconitum noveboracense*	Threatened	No	Along cool sites of streams and cliffs; found in 6 counties in central and northeastern Iowa.
Prairie Bush-clover	*Lespedeza leptostachya*	Threatened	No	Tallgrass prairie regions with moderately moist soil. Found in 99 counties throughout Iowa.
Western Prairie Fringed Orchid	*Platanthera praeclara*	Threatened	No	Prairies and meadows. Found in 98 counties throughout Iowa.

Source: (USFWS, 2015c)

Eastern Prairie Fringed Orchid. The eastern prairie fringed orchid, also known as the eastern prairie orchid, grows between 8 to 40 inches in height with a stalk of up to 40 white flowers, each with three fringed lips and a nectar tube (USFWS, 2015q). The species was federally listed as threatened in 1989 (54 FR 39857, September 28, 1989). Regionally, this species is known to occur primarily in the Great Lakes and Illinois region, though also sparsely occurs from Maine south to Georgia. In Iowa, it can be found in Decatur, Jackson, Johnson, and Jones counties in eastern and southern portions of the state (USFWS, 2015c).

The prairie orchid grows in a variety of habitats, from wetlands to prairies and requires full sun. Seedlings require soil fungi (called mycorrhizae) to establish themselves and develop more complete root systems. Seed capsules mature over the growing season and are dispersed by the wind from late August through September. Plants may only flower once every few years (USFWS, 2015q). Threats to the eastern prairie orchid include altered hydrology, invasive plant species, succession to woody vegetation, foot traffic, and collection (USFWS, 2012d).

Mead's Milkweed. Mead's milkweed is a tallgrass herb characterized by a single stem which grows up to 16 inches tall, and was listed as threatened in 1988 (53 FR 33992, September 1, 1988). The species has hairless leaves, a white wax coating, and a singular cluster of flowers at the top (USFWS, 2005). Regionally, it is known or believed to occur in Illinois, Indiana, Iowa, Kansas, Missouri, and Wisconsin. In Iowa, it can be found in five counties in the southern portion of the state (USFWS, 2015c).

Habitat for the species includes "moderately wet to moderately dry upland tallgrass prairie or glade/barren habitat characterized by vegetation adapted for drought and fire" (USFWS, 2005), which include stable prairie habitats. Threats to the species include habitat loss from farming and commercial development, habitat fragmentation which reduce genetic diversity and pollinators, and hay mowing, which occurs in agricultural areas and can eliminate the early stages of the species' lifecycle (USFWS, 2005).

Northern Wild Monkshood. Northern wild monkshood is an herbaceous perennial of between 1 to 4 feet in height and has adapted for pollination by bumblebees with hood-shaped blue flowers of approximately 1 inch in length (USFWS, 2015y). The species was listed as threatened in 1978 (43 FR 17910, April 26, 1978). The species' range is interspersed from central Iowa to eastern New York between "three distinct regions: in and adjacent to the unglaciated portion of Iowa and Wisconsin, the northeastern Ohio glaciated area and the Catskill Mountains of New York" (USFWS, 1983). In Iowa, it can be found in the northeastern portion of the state (Iowa Department of Agriculture, 2016).

The northern wild monkshood habitat occurs along cool moist sites of streams and cliffs of talus (loose rock) (USFWS, 2015r). Threats include dams and reservoirs and other sources that have resulted in degradation and loss of habitat, construction and maintenance activity, logging operations, quarrying, grazing, and collection by humans (USFWS, 1983).

Prairie Bush-clover. The prairie bush-clover is a perennial member of the pea family, with pinkish-cream flowers, clover-like leaves, and a silvery gloss which was listed as threatened in 1987 (52 FR 781, January 9, 1987) (USFWS, 2015s). The species' range primarily extends from Iowa to the shore of Lake Michigan, reaching north to the twin cities and south to central Illinois. Within Iowa, the species is known or believed to occur in all 99 counties throughout the state (USFWS, 2016c).

Habitat for the prairie bush-clover consists of tallgrass prairie regions, with moderately moist soils that are typically utilized for cropland, though the species has continued to thrive on slopes and rocky areas with similar soils. Threats include conversion of prairie tallgrass areas to cropland, "overgrazing, agricultural expansion, herbicide application, urban expansion, rock quarrying, and transportation right-of-way maintenance and rerouting; hybridization with the more common round-headed bush clover" (USFWS, 2015z).

Western Prairie Fringed Orchid. The Western prairie fringed orchid grows stalks up to 4 feet tall with up to 24 white flowers (USFWS, 2015t). The species was federally listed as threatened in 1989 (54 FR 39857, September 28, 1989) and can be found along the edge of the plains from Minnesota south to Oklahoma. In Iowa, the western prairie fringed orchid can be found in 98 of 99 counties throughout the state (USFWS, 2016c).

The orchid is found in prairies and meadows and utilizes support from mycorrhizal fungi during seed germination and before plants are capable of photosynthesis. The western prairie fringed orchid requires measured periodic disturbance (i.e., fire, mowing, or grazing) and consistent soil moisture. Threats to the species include land conversion, impacts to the few species of sphinx moths which pollinate the orchid, and lowering of groundwater levels (USFWS, 1996).

6.1.7. Land Use, Recreation, and Airspace

6.1.7.1. Definition of the Resource

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

Land Use, Recreation, and Airspace

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

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

Descriptions of land uses are presented in three primary categories: agricultural, forest and woodland, and developed. Descriptions of land ownership are presented in four main categories: private, federal, state, and tribal. Descriptions of recreational opportunities are presented in a regional fashion.

Airspace

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

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

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

6.1.7.2. Specific Regulatory Considerations

Section 1.8, Overview of Relevant Federal Laws and Executive Orders and Appendix C, Environmental Laws and Regulations, summarizes numerous federal environmental laws and regulations that, to one degree or another, may affect land use in Iowa. 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.

Because the Nation's airspace is governed by federal laws, there are no specific Iowa state laws that would alter the existing conditions relating to airspace for this PEIS. State statutes pertaining to airspace safety, flight safety at public airports, and obstruction is addressed in Iowa Code - 2015, Title VIII - Transportation, Chapters 328 – 330A (Iowa Legislature, 2015).

6.1.7.3. Land Use and Ownership

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

Land Use

Table 6.1.7-1 identifies the major land uses by coverage type in Iowa. Agriculture comprises the largest portion of land use with over 80 percent of Iowa's total land area occupied by this category (Table 6.1.7-1 and Figure 6.1.7-1). Forest and Woodland is the second largest area of land use with 8.6 percent of the total land area. Developed areas account for approximately 7.4 percent of the total land area. Surface water acreage accounts for approximately one percent of the total land area. The remaining percentage of land includes public land and other land covers, shown in Table 6.1.7-1, that are not associated with specific land uses (USGS, 2012c).

Table 6.1.7-1: Major Land Use in Iowa by Coverage Type

Land Use	Square Miles[a]	Percent of Land
Agriculture	45,425	81.3%
Forest and Woodland	4,814	8.6%
Developed	4,117	7.4%
Surface Water	524	1.0%
Public Land and Other Land Cover	977	1.7%

Source: (USGS, 2012c)

[a] Square miles are rounded to the nearest whole number. The maps and tables are prepared from the analysis of high altitude imagery; an inherent 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.

Agricultural Land

Agricultural land exists in every region of the state (Figure 6.1.7-1). Over 80 percent (45,425 square miles) of land in Iowa is classified as agricultural. In 2012, there were 88,637 farms in Iowa and most were owned and operated by small, family businesses, with most farms less than 345 acres in size (USDA, 2012). Some of the state's largest agricultural uses include corn, soybeans, hay, oats, wheat, apples, and potatoes. Other agricultural uses include raising cattle for dairy and meat, as well as goats, sheep and hogs. For more information by county, access the USDA Census of Agriculture website:
http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/Iowa/

Forest and Woodland

Forest and woodland areas can be found throughout the state, many of them located along rivers and streams. The largest concentrations of forests are located in the eastern (such as along the Mississippi River) and southern (such as along the Des Moines River) parts of the states (USGS, 2015c). Section 6.1.6.3 presents additional information about terrestrial vegetation.

State Forest

Iowa state forests are comprised of 10 units totaling 43,917 acres (Table 6.1.7-2), all managed by IDNR under the principle of multiple use, with an emphasis on "demonstrating good woodland management and providing forest products, wildlife habitat and a variety of outdoor recreational opportunities." (IDNR, 2015s).

Table 6.1.7-2: Iowa State Forests

State Forest Name	Acres
Yellow River State Forest	8,503
Shimek State Forest	9,148
Stephens State Forest	15,170
Loess Hills State Forest	10,600
Gifford State Forest	40
Backbone State Forest	186
White Pine Hollow State Forest	944
Holst State Forest	*
Barkley State Forest	*
Pilot Mound State Forest	*

Source: (IDNR, 2015s)

* IDNR webpage indicates that these parks range in size from 34 to 314 acres; specific acreages are not given for these parks.

Developed Land

Developed land in Iowa tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 6.1.7-1). Although only 7.4 percent of Iowa land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 6.1.7-3 lists the top five developed metropolitan areas within the state and their associated population estimates, and Figure 6.1.7-1 shows where these areas are located within the Developed land use category.

Table 6.1.7-3: Top Five Developed Metropolitan Areas (2014 Estimate)

Metropolitan Area	Population Estimate
Des Moines, IA	450,070
Cedar Rapids, IA	177,844
Davenport, IA—IL	142,901
Waterloo, IA	113,418
Iowa City, IA	106,621
Total Estimated Population of Metropolitan Areas	990,854
Total State Estimated Population	3,107,126

Source: (U.S. Census Bureau, 2016a)

Land Ownership

Land ownership within Iowa has been classified into four main categories: private, federal, state, and tribal.

Private Land

The majority of land in Iowa is privately owned, with most of this land falling under the land use categories of agricultural, forest and woodland, and developed (Figure 6.1.7-1). Highly developed, urban, metropolitan areas transition into suburban, agriculture, shrub, and woodland areas. Private land exists in all regions of the state.[83]

Federal Land

The federal government manages 267.24 square miles (less than 1 percent) of Iowa land with a variety of land types and uses, including national monuments, historic sites, military bases, and wildlife refuges (Table 6.1.7-4) (USGS, 2012d) (USGS, 2014h). Six federal agencies manage the majority of federal lands throughout the state (Table 6.1.7-4 and Figure 6.1.7-2).[84] There may be other federal lands, but they are not shown on the map due to their small size relative to the entire state.

Table 6.1.7-4: Federal Land in Iowa

Agency	Square Miles	Representative Type
NPS[a]	4.20	National Monument, National Historic Site
USFWS	494.60	National Wildlife Refuges
Department of Defense	137.40	Ammunition plant, military camp
Bureau of Land Management	0.39	Grazing lands
Natural Resources Conservation Service	0.03	Conservation land
USACE	0.22	Recreation and flood risk management areas
Total	**267.24**	

Sources: (USGS, 2012d) (USGS, 2014h; USFWS, 2016e)

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

The Department of Defense owns and manages 137.4 square miles used for the Iowa Army Ammunition Plant and Camp Dodge; the USFWS owns and manages 7 National Wildlife Refuges in Iowa (494.6 square miles); and the National Park Service manages 4.2 square miles consisting of the Effigy Mounds National Monument and other NPS units (USGS, 2014h).

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

[84] 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.

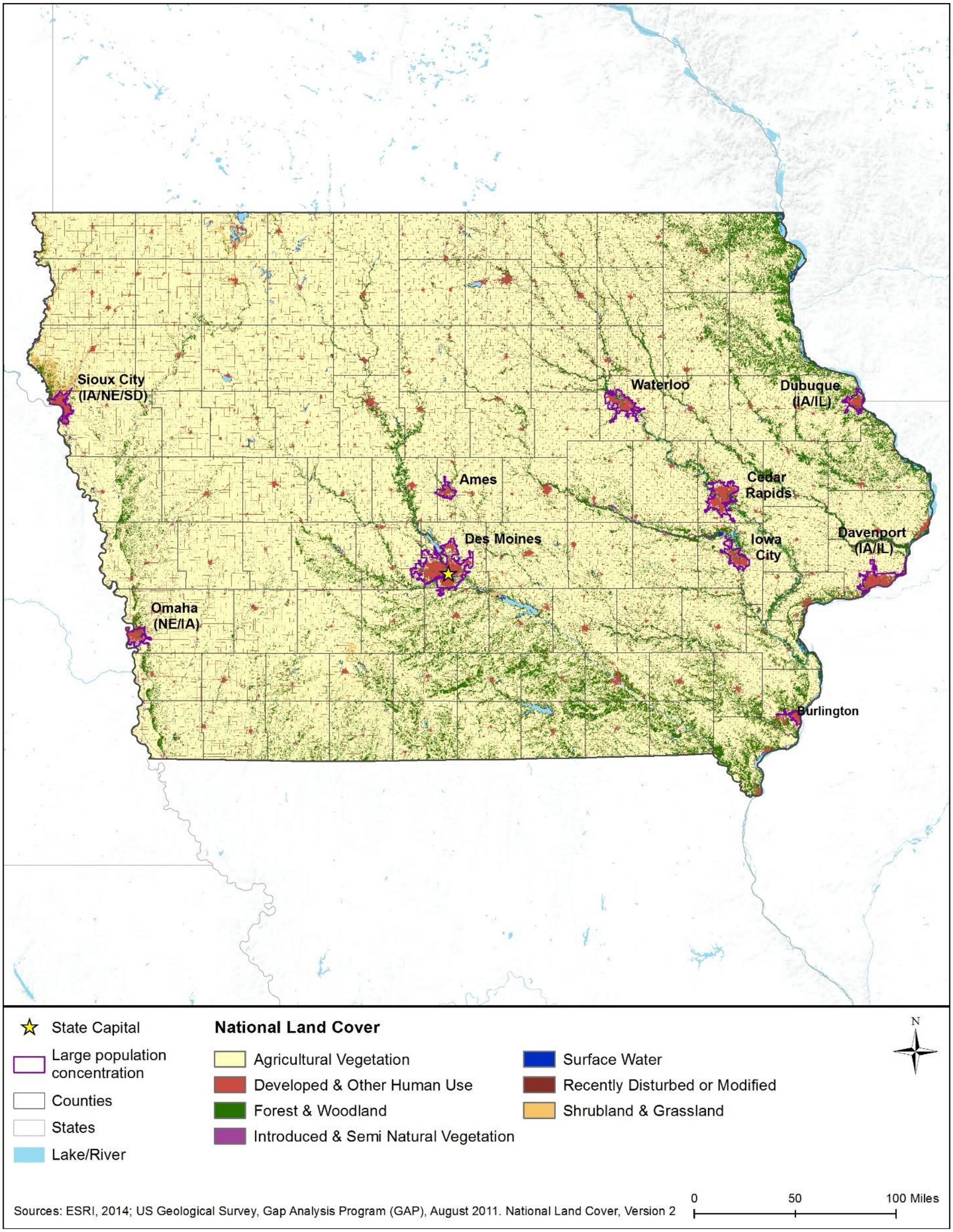


Figure 6.1.7-1: Major Land Use Distribution by Coverage Type

State Land [85]

The Iowa state government owns over 734 square miles of land comprised of forests and woodlands, historic sites, state offices, and recreation areas. The IDNR manages 99 percent of state lands (Table 6.1.7-5).

Table 6.1.7-5: State Land in Iowa

Agency	Square Miles[a]	Type
Iowa Department of Natural Resources	92	State Parks and Recreation Areas
Iowa Department of Natural Resources	18	State Preserves
Iowa Department of Natural Resources	68	State Forests
Iowa Department of Natural Resources	556	Wildlife Management Areas

Source: (IDNR, 2015t)

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

The IDNR manages 72 State Parks and Recreation Areas (92 square miles); 95 Iowa Preserves "dedicated for the permanent protection of significant natural and cultural features" (18 square miles); 10 Iowa state forests (68.6 square miles) co-managed with the Forestry Bureau; and multiple Iowa WMAs (556.2 square miles) (IDNR, 2015u). For additional information on wildlife refuges and management areas, see Section 6.1.6.4, Wildlife.

Tribal Land

The Bureau of Indian Affairs, along with individual tribes, manages 13.23 square miles of land within Iowa.[86] These lands are composed of three Indian Reservations and one Trust Land currently located in various parts of the state (USGS, 2012d) (USGS, 2014h). For additional information regarding historic tribes in Iowa, see Section 6.1.11, Cultural Resources.

Table 6.1.7-6: Indian Reservations of Iowa

Reservation Name	Square Miles
Sac and Fox Tribe of the Mississippi in Iowa (Meskwaki Nation) Trust Land	1.03
Sac and Fox Tribe of the Mississippi in Iowa (Meskwaki Nation) Reservation	5.34
Winnebago Tribe of Nebraska Reservation	1.13
Omaha Tribe of Nebraska Reservation	5.72
Total	**13.23**

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

[85] 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.

[86] 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.

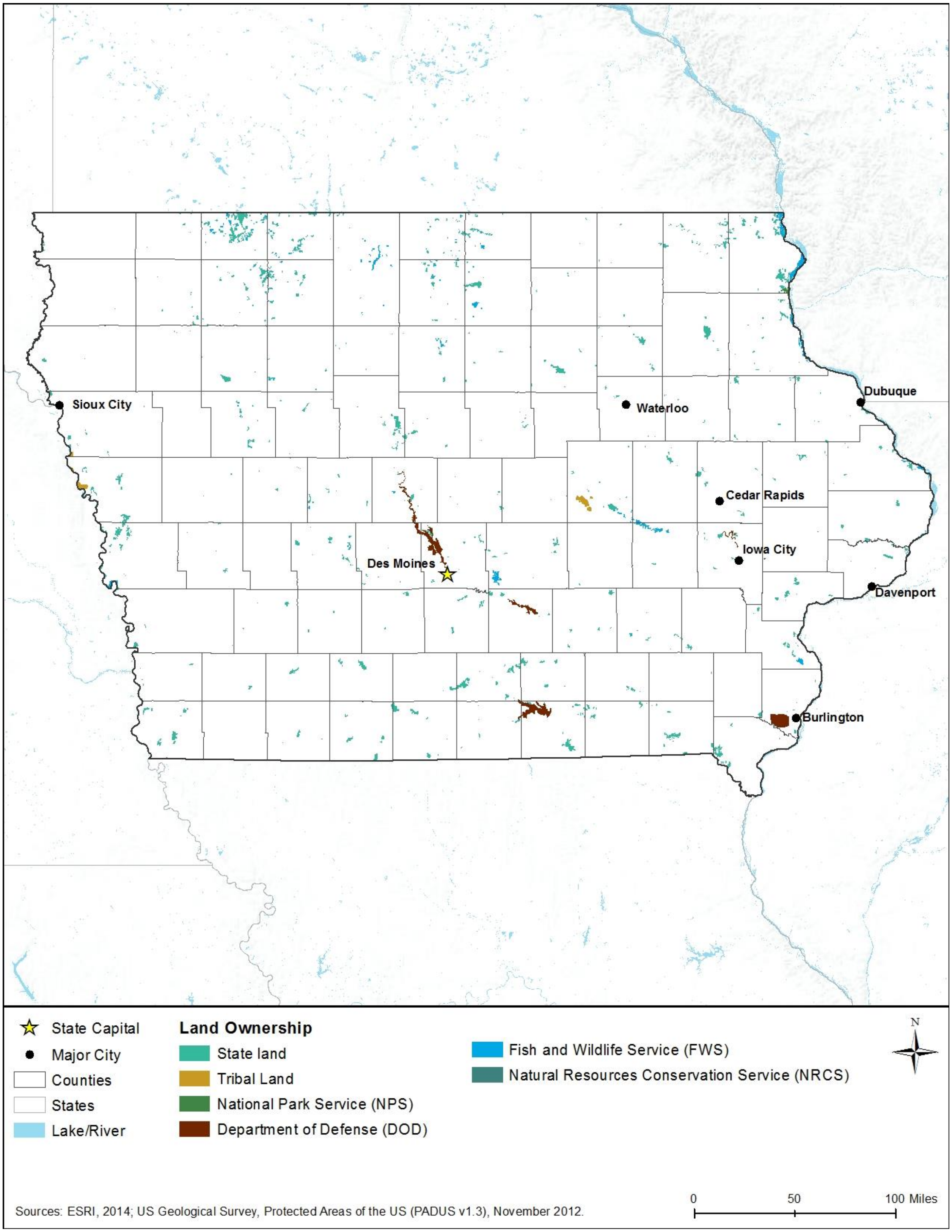


Figure 6.1.7-2: Land Ownership Distribution

6.1.7.4. Recreation

Iowa's terrain is largely a landscape of rolling plains and upland hills with tallgrass prairies, and dispersed areas of dense oak forests, wetlands, and river bluffs. The majority of the land is utilized for raising agricultural crops and livestock. Iowa is situated between the Mississippi River, Wisconsin, and Illinois to the east, and the Missouri and Big Sioux Rivers, South Dakota, and Nebraska to the west. To the north is Minnesota and to the south is Missouri. 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, cross country skiing and snowmobiling 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 52 State Parks, 11 State Recreation Areas, 9 other managed areas, and 95 State Preserves (IDNR, 2015v). Eight Off-Highway Vehicle (OHV) designated riding parks have been developed by IDNR (IDNR, 2015w). There are no National Forests in Iowa, but the state manages 4 major and 6 minor forest units. Iowa has 70,247 miles of river with no designated wild and scenic rivers (National Wild and Scenic Rivers System, 2015b).Availability of river, stream, and lake resources makes water-based recreation very popular with residents and visitors. One of the oldest, largest, and longest cross-state bicycling events in the U.S. is Register's Annual Great Bicycle Ride Across Iowa or “RAGBRAI” is a weeklong event now limited to 8,500 riders because of its popularity (RAGBRAI, 2015). There are 24 National Recreation Trails in the state, traversing more than 422 total miles (American Trails, 2015a). Federally, the NPS, USFWS, and the USACE manage areas in Iowa with recreational attributes.

This section discusses key recreational opportunities and activities representative of various regions of Iowa. The state can be categorized by three distinct recreational regions, each of which is presented in the following sub-sections. For information on visual resources such as National Scenic Byways and state-designated Byways, see Section 6.1.8, Visual Resources; and for information on culturally/historically significant resources (e.g., National Historic Sites, National Historic Landmarks [NHLs], sites on the National Register of Historic Places [NRHP], and Natural Heritage Areas), see Section 6.1.11, Cultural Resources.

Northern Region

The Northern Region is best known for its lakes (especially Spirit Lake and Clear Lake), resort towns like Okoboji, and a high concentration of state parks, recreation areas, and preserves. This region is largely rural with small towns and cities (Figure 6.1.7-3).[87] Forests, bluffs, lakes, rivers and streams dominate this region's landscape. Outdoor enthusiasts visit this region for its

[87] 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.

impressive variety of water and boating sports, fishing, and to the woods for hunting, camping, hiking, skiing, bicycle, horse, all-terrain vehicle, and snowmobile riding (Travel Iowa, 2015). The Yellow River State Forest's remarkably hilly terrain in northeast Iowa is especially popular for those opportunities. Birding, particularly for sighting bald eagles, also draws visitors to this area (IDNR, 2015x).

Storm Lake has King's Pointe Waterpark Resort and Waterloo has Lost Adventure Park. Charles City, Elkader, and Manchester Whitewater Parks cater to kayakers and rafters, and the Iowa River hosts tubers. Backbone State Park is popular with rock climbers and Pikes Peak State Park with hikers. Orange City highlights its Dutch heritage with historical sites and attractions, and Decorah's “Vesterheim” captures Norwegian-American folk art and artifacts. Sioux City's Art Center and Dubuque's National Mississippi River Museum and Aquarium are also popular tourist destinations (Travel Iowa, 2015).

Central Region

The Central Region is bordered on the west by the Missouri River and the cities of Sioux City and Council Bluffs, Iowa, and adjacent Omaha, Nebraska. On the east are the Mississippi River, and the cities of Dubuque and Davenport/Bettendorf, Iowa and adjacent Moline and Rock Island, Illinois (Figure 6.1.7-3). Des Moines, the capital, is in the center of this region, and serves as the entertainment hub for the state with arts and cultural districts, and a Riverwalk. One of the most popular attractions in Dubuque is the Fenelon Place Elevator, a scenic incline railway that leads to an observation deck that provides views of the city, Mississippi River, and three states. The 13-story High Trestle Trail crosses the Des Moines River valley between Woodward and Madrid. Motorsports racing fans visit the Iowa Speedway in Newton. Lake Panorama, Saylorville Lake, and Coralville Lake, each with adjacent State Parks, offer Des Moines and Cedar Rapids residents and visitors convenient opportunities for expanded outdoor recreation activities (Travel Iowa, 2015).

Manning's “Hausbarn” and Amana's “Colonies” celebrate German immigrants and their traditional crafts; while Cedar Rapid's Slovak and Czech cultures are highlighted in the New Bohemia Main Street District and the National Czech and Slovak Museum and Library. Amish communities are also present, with farms and shops for visitors to purchase their foods and products. Davenport and Bettendorf, the Iowa half of the “Quad Cities” (adjacent Rock Island and Moline, Illinois being the other two) are well known for their festivals, theater, arts, music, and nightlife (Travel Iowa, 2015).

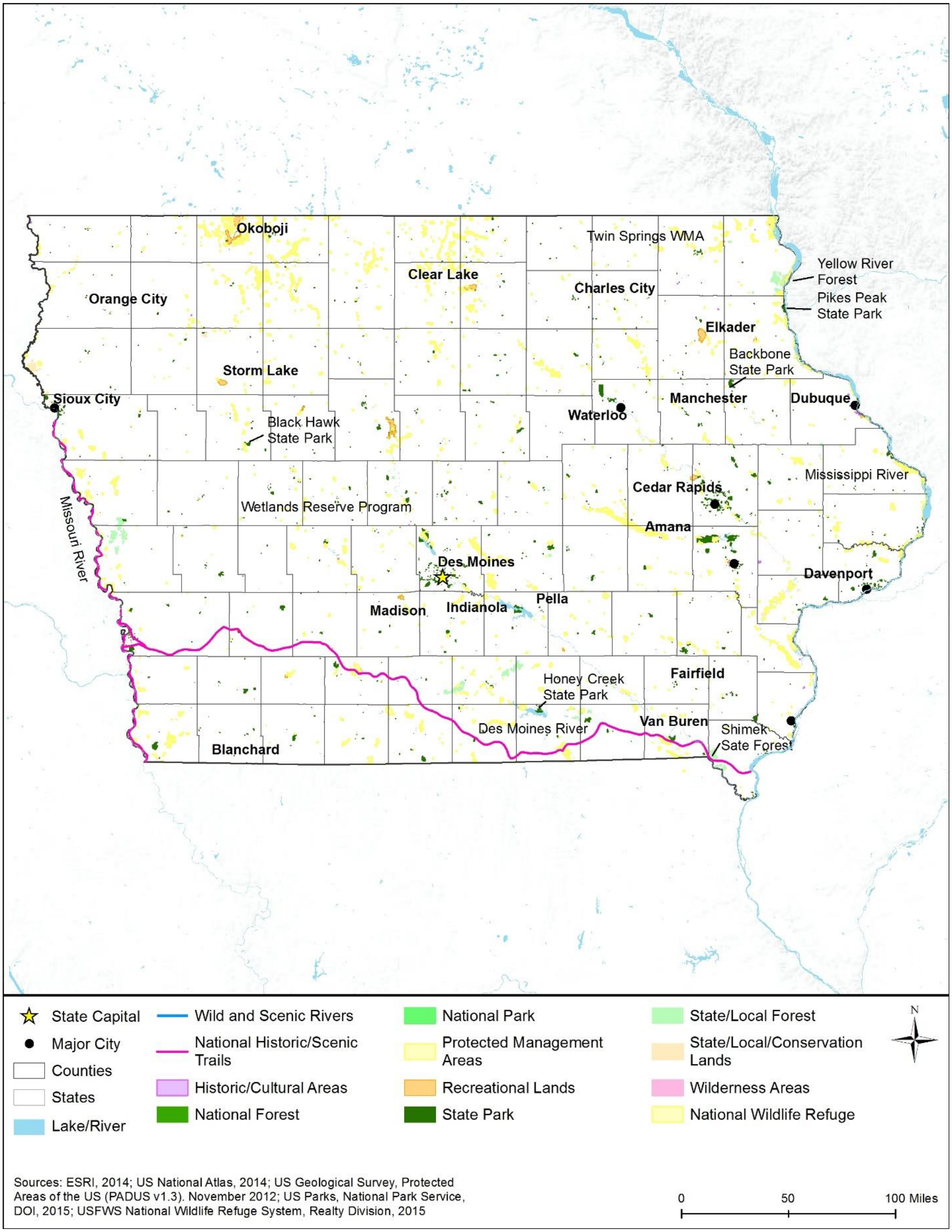


Figure 6.1.7-3: Iowa Recreation Resources

Southern Region

The Southern Region is largely rural with small towns and cities. The Loess Hills in the south western portion of this region are a unique land formation, composed almost entirely of windblown soils from the Ice Age. Popular for hiking, the 640,000 acres of dune shaped loess deposits in Iowa are the second highest in the world (Loess Hills National Scenic Byway, 2014). The Des Moines River flows through this area, and meets the Mississippi River at Keokuk. Several dispersed units of the Stephens and Shimek State Forests are located in this region. With its wilderness-like character, campgrounds, lakes, and multi-use trails these units provide plenty of opportunities for hiking, biking, horseback riding, boating, hunting, fishing, and wildlife viewing (IDNR, 2015x). Rathbun Lake and its Honey Creek State Park Resort, and Lake Red Rock and Elk Rock State Park are premier recreation destinations (Figure 6.1.7-3).

Council Bluffs has casino resorts and several popular museums highlighting historic trails and railroads. Wabash Trace Nature Trail, from Council Bluffs to Blanchard is a popular 63-mile multi-use trail (Iowa Natural Heritage Foundation, 2015). Indianola's National Balloon Classic, Winterset's covered “Bridges of Madison County,” and Pella's Tulip Time Festival are popular tourist events and attractions. The 12 quaint villages located in Van Buren County attract many visitors, not only for the historic districts, festivals, local artisans, and specialty shops, but for the abundance of nearby recreation areas (Travel Iowa, 2015).

Near Fairfield, the Maharishi Vedic City's Observatory is a fascinating place for visitors to explore the use of sundials and witness demonstrations on the movements of the sun, planets, and stars in the universe. The city also has an internationally renowned health center and spa (Maharishi Vedic City, 2010).

6.1.7.5. Airspace

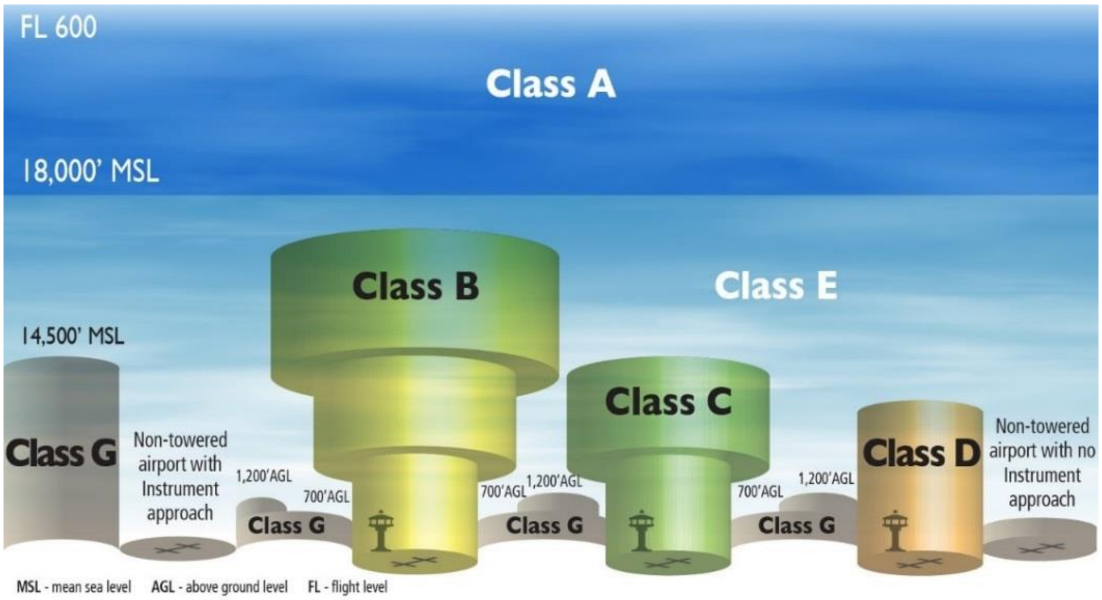
The FAA uses the NAS to provide for aviation safety. The NAS includes Special Use Airspace (SUA) consisting of Restricted Areas, Warning Areas, and Military Operation Areas (MOAs). The FAA controls the use of the NAS with various procedures and practices (such as established flight rules and regulations,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

Airspace Categories

There are two categories of airspace or airspace areas:

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

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 6.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[88] service is based on the airspace classification (FAA, 2008).



Source: Derived from (FAA, 2008)

Figure 6.1.7-4: National Air Space Classification Profile

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[89]. 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).[90]
- **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

[88] ATC – Approved authority service to provide safe, orderly, and expeditious flow of air traffic operations (FAA, 2015d).
[89] 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).
[90] IFR – Rules for the conduct of flights under instrument meteorological conditions (FAA, 2015d).

4,000 feet above the airport elevation. Entering Class C airspace requires radio contact with the controlling ATC authority, and an ATC clearance is ultimately required for landing.
- **Class D:** Airspace from the surface to 2,500 feet above the airport elevation surrounding airports with an operational control tower. Airspace area is tailored. Aircraft entering the airspace must establish and maintain radio contact with the controlling ATC.
- **Class E:** Controlled airspace not designated as Class A, B, C, or D. Class E airspace extends upward from the surface or a designated altitude to the overlying or adjacent controlled airspace (FAA, 2008).

Uncontrolled Airspace

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

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (See Table 6.1.7-7).

Other Airspace Areas

Other airspace areas, explained in Table 6.1.7-8, 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 6.1.7-7: SUA Designations

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

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

Aerial System Considerations

Unmanned Aerial Systems

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

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

Balloons

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

Obstructions to Airspace Considerations

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

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

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

Table 6.1.7-8: Other Airspace Designations

Type	Definition
Airport Advisory	There are three types: • Local Airport Advisory – Operated within 10 statute (5,280feet/mile) miles of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. • Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. • Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: • Protect people and property from a hazard; • Provide safety for disaster relief aircraft during operations; • Avoid unsafe aircraft congestion associated with an incident or public interest event; • Protect the U.S. President, Vice President, and other public figures; • Provide safety for space operations; and • Protect in the state of Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of "permanent" are included in this Final 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.

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

Iowa Airspace

The Iowa Office of Aviation is a component of the Iowa Department of Transportation. The Office of Aviation "promotes and enhances a healthy air transportation system. Emphasis is placed on building cooperative working relationships, advocating for opportunities to strengthen aviation in Iowa, coordinating outreach programs, maintaining a comprehensive data collection system, and managing programs that promote a safe and secure air transportation system in Iowa" (IDOT, 2016). The Office of Aviation achieves these goals through "administration of federal and state aviation funding programs, inspection and certification of all public use airports, aviation system planning, and air service analysis and development (IDOT, 2016)." There is one FAA FSDO for Iowa located in Des Moines (FAA, 2015f).

Iowa 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 (Iowa Department of Transportation, 2010). Figure 6.1.7-5 presents the different aviation airports/facilities residing in Iowa, while Figure 6.1.7-6 and Figure 6.1.7-7 present the breakout by public and private airports/facilities. There are 290 airports in Iowa, as presented in Table 6.1.7-9 and Figure 6.1.7-5 through Figure 6.1.7-7 (USDOT, 2015a).

Table 6.1.7-9: Type and Number of Iowa Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	121	80
Heliport	0	87
Seaplane	0	0
Ultralight	0	2
Balloonport	0	0
Gliderport	0	0
Total	121	169

Source: (USDOT, 2015b)

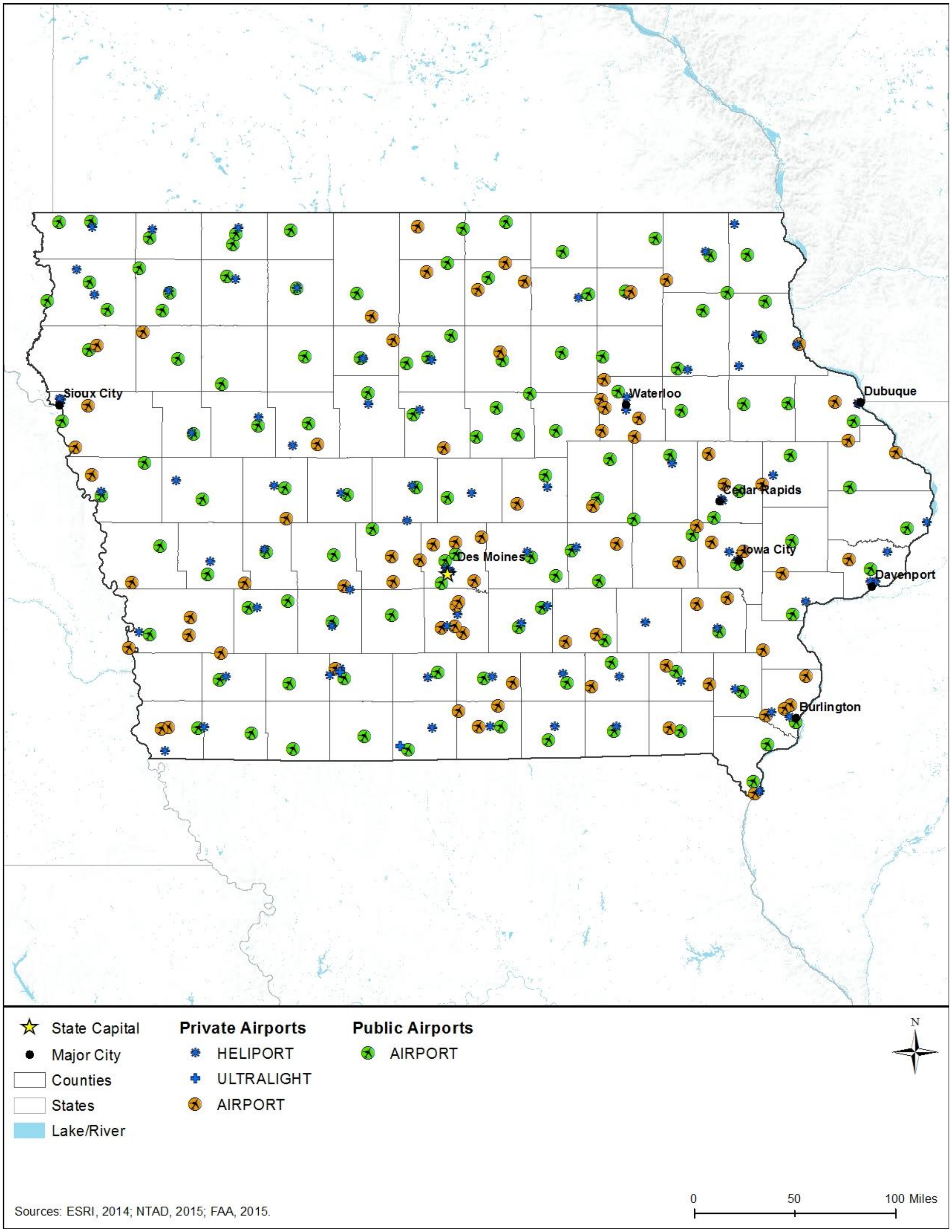


Figure 6.1.7-5: Composite of Iowa Airports/Facilities

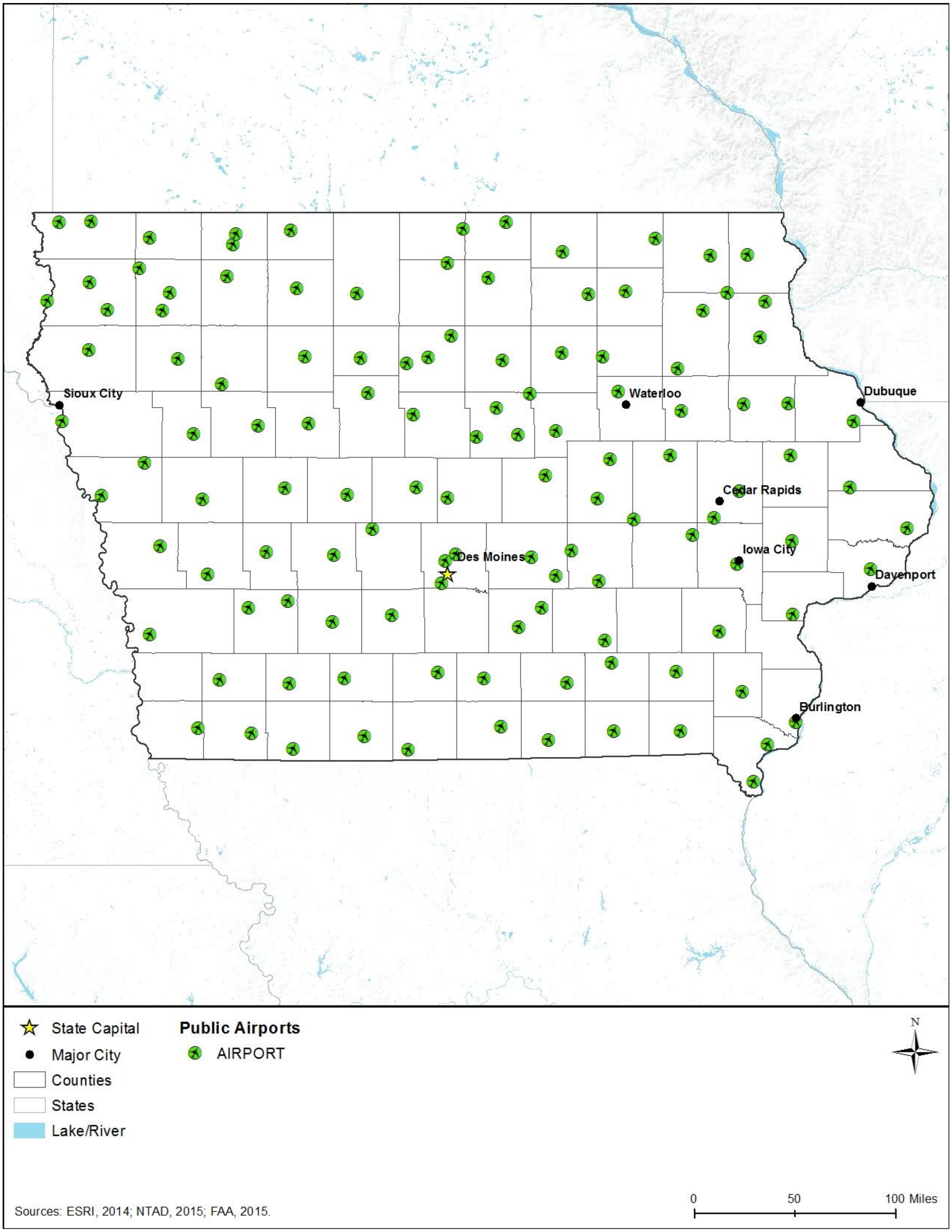


Figure 6.1.7-6: Public Iowa Airports/Facilities

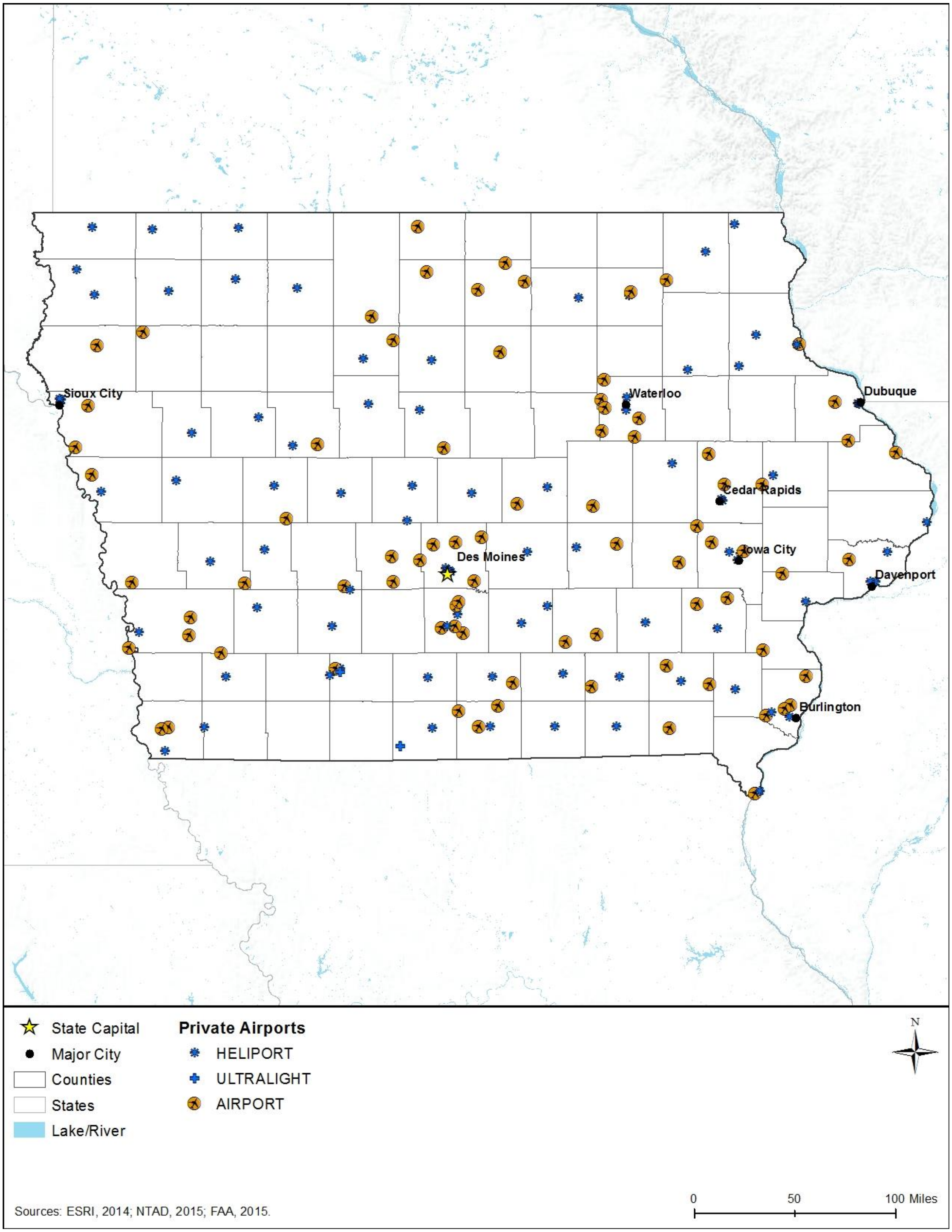


Figure 6.1.7-7: Private Iowa Airports/Facilities

There is Class C and Class D controlled airports in Iowa as follows:

- Two Class C –
  - Des Moines International
  - Eastern Iowa Airport, Cedar Rapids
- Two Class D –
  - Dubuque Regional
  - Sioux Gateway/Col. Bud Day Field, Sioux City. (FAA, 2015g)

SUAs (i.e., three MOAs) located in Iowa are as follows:

- Crypt –
  - Central – 8,000 feet MSL to, but not including, FL 180
  - North – 8,000 feet MSL to, but not including, FL 180
  - South – 8,000 feet MSL to, but not including, FL 180. (FAA, 2016)

The SUAs for Iowa are presented in Figure 6.1.7-8. There are no TFRs (See Figure 6.1.7-8) (FAA, 2015h). MTRs in Iowa, presented in Figure 6.1.7-9, consist of two Visual Routes.

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, 2014b). There are two NPS units in Iowa that must comply with this agency directive (NPS, 2016a).

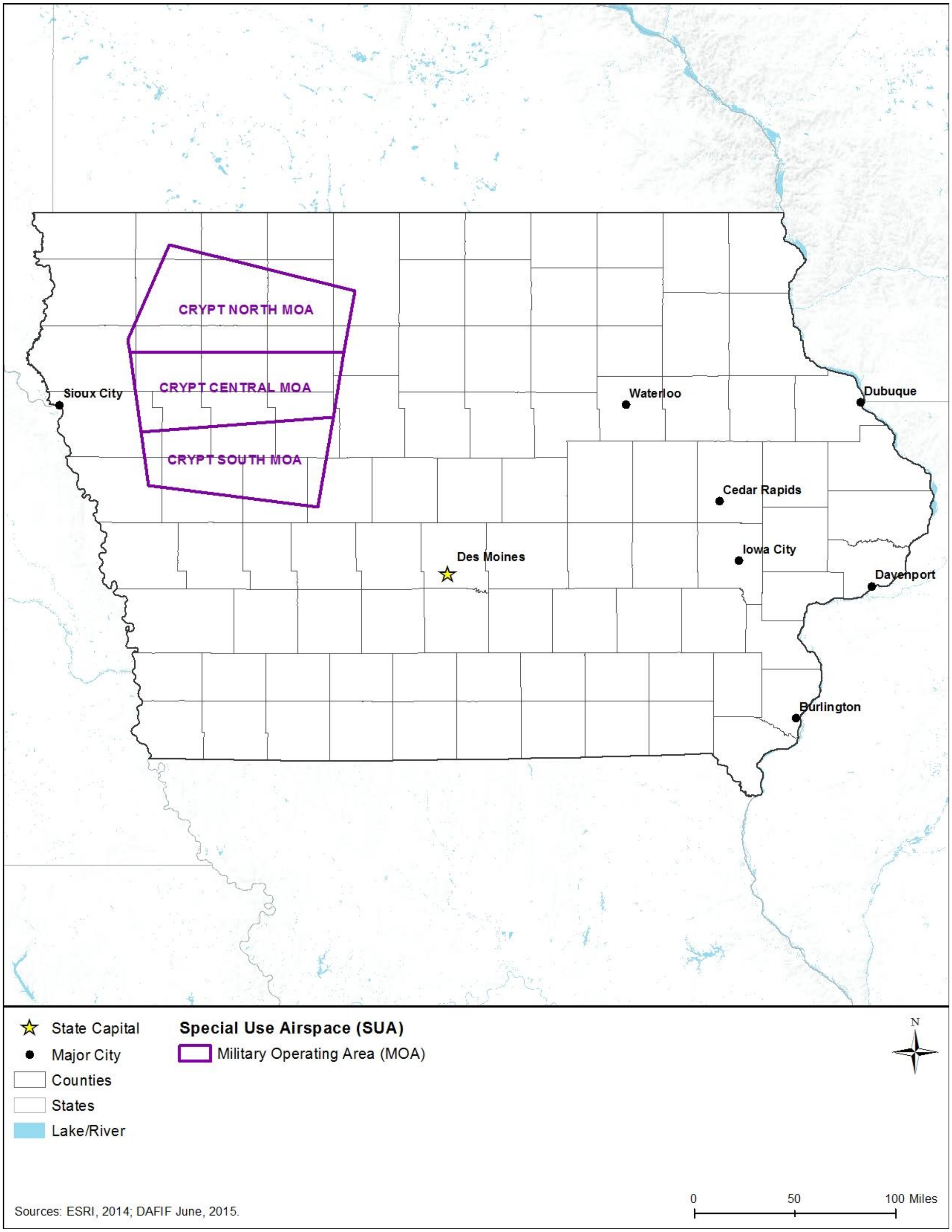


Figure 6.1.7-8: SUAs in Iowa

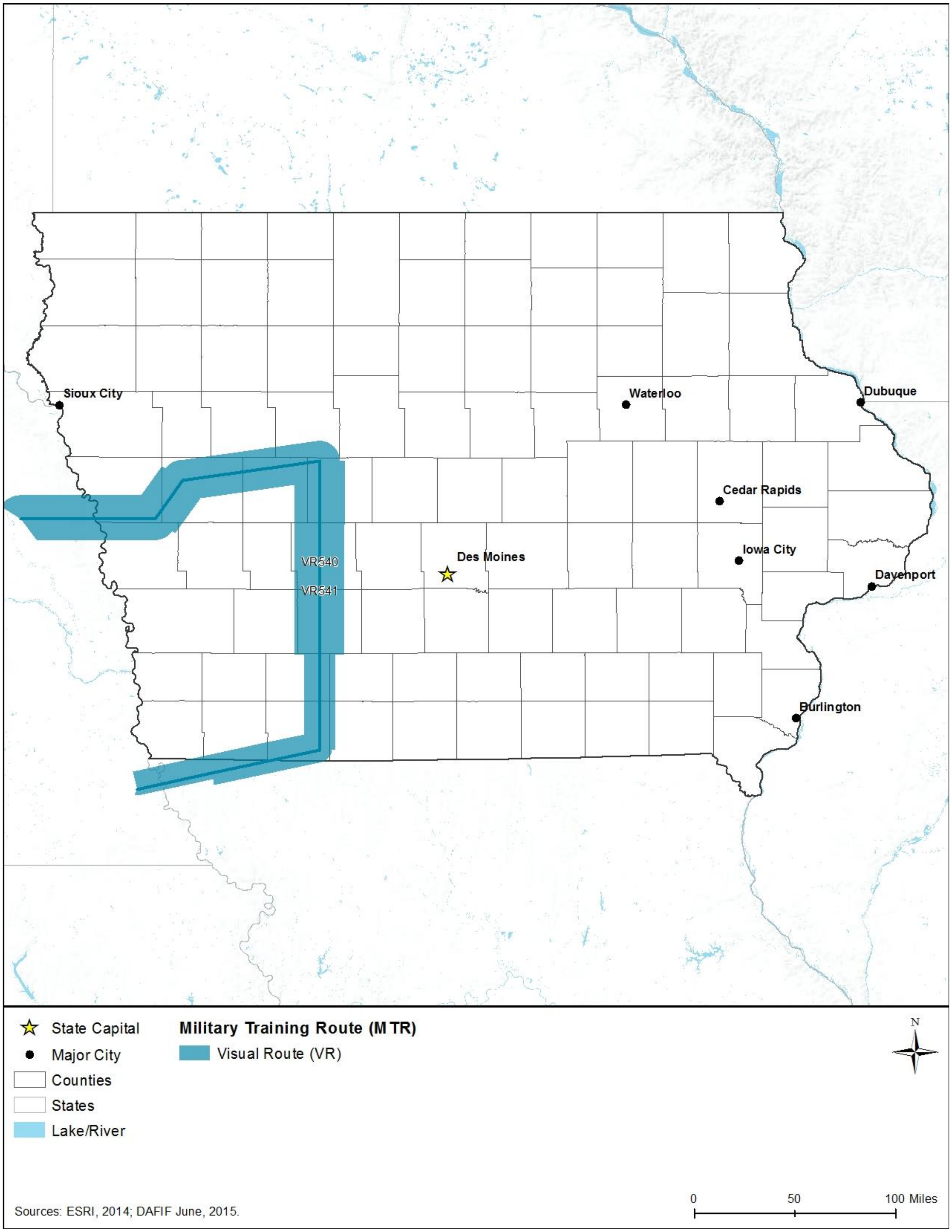


Figure 6.1.7-9: MTRs in Iowa

6.1.8. Visual Resources

6.1.8.1. Introduction

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).

6.1.8.2. Specific Regulatory Considerations

Table 6.1.8-1 presents state and local laws and regulations that relate to visual resources.

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

State Law/Regulation	Regulatory Agency	Applicability
State Historical Society of Iowa (Iowa Code 303 § 4-35)	State Historical Division	Establishes the Historical Division of the Iowa Department of Cultural Affairs to administer historical sites, acquire historical sites, identify and document historic properties and prepare a state register of historic places; establishes the State Historical Society of Iowa.
Iowa Scenic Byway Program (Iowa Code, Rule 761 Chapter 132 § 1-3 et seq.)	IDOT	Establishes the state scenic byway program and identifies three categories of scenic roads in the state including: 1) naturally scenic, 2) scenic and heritage, and 3) heritage.
State Preserves (Iowa Code, Chapter 465C)	State Preserves Advisory Board	Establishes the State Preserves Advisory Board to advise IDNR on the "acquisition, dedication, and management of state preserves."
Homestead (Iowa Code, Chapter 561)	IDNR	Establishes the primary responsibilities of IDNR, including "state parks and forests, protecting the environment, and managing energy, fish, wildlife, and land and water resources in [the] state." Identifies mission of the IDNR "to conserve and enhance our natural resources in cooperation with individuals and organizations to improve the quality of life in Iowa."

Sources: (Iowa Department of Legislature, 2017d), (Iowa Department of Legislature, 2017e), (Iowa Department of Legislature, 2017f), (Iowa Department of Legislature, 2008)

In addition to the state laws and regulations, in Iowa, local jurisdictions have the authority to establish historic preservation programs to preserve historic and cultural resources, which contain important visual resources (State Historical Society of Iowa, 2014).

6.1.8.3. Character and Visual Quality of the Existing Landscape

Iowa has a variety and contrast of visual resources. The state is home to landscape as the Loess Hills, Southern Drift Plains, Paleozoic Plateau, and Northwest Iowa Plains and to two major rivers, the Mississippi and Missouri (IDNR, 2016b). The largest manager of public lands in Iowa is the USACE with 141.64 acres. Additionally, the Bureau of Land Management (BLM), NPS, and USFWS also maintain lands in the state (Natural Resources Council of Maine, 1995).

Agriculture lands are the most prevalent visual resource within Iowa, comprising approximately 81 percent of the total land cover. Forestland and woodlands account for approximately 8.6 percent of total land cover (Figure 6.1.7-1 in Section 6.1.7, Land Use, Recreation, and Airspace) (USGS, 2012c).

Cropland's visual resources consist of either row crops, closely sown crops or fallow land awaiting planting. Crops may include hay, silage, fruit trees, berries, tree nuts, vegetables, or melons (USDA, 2014b). The state grows more corn than any other state and more than most countries (Iowa Corn Growers Association, 2015). Forested lands are the second most prevalent visual resource within the state (USDA, 2015b). Visual resources within forested areas are generally comprised of continuous, natural looking cover with gradual transitions of line and color. They are typically characterized by the lack of disturbance or disruption of the landscape. One aspect of importance for visual resources is to maintain the character of the area. For example, in a farm community, keeping the character of the town consistent with farm-style houses, barns, and silos would be key in maintaining the character of the community. In a more metropolitan area, there may be many different visual styles within each neighborhood, but keeping the character of the neighborhood is important to maintain if new development were to occur. Section 6.1.10 discusses land use and contains further descriptions of land cover within the state.

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.

6.1.8.4. Visually Important Historic Properties and Cultural Resources

Visual and aesthetic qualities of historic properties can contribute to the overall importance of a particular site. Such qualities relate to the integrity of the appearance and setting of these properties or resources. Viewsheds (the natural and manmade environment visible from one or more viewing points) can also contribute to the significance of historic properties or cultural resources (NASA, 2013). Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape. Figure 6.1.8-1 shows areas that are included in the NRHP that may be considered visually sensitive. In Iowa, there are 2,270 NRHP listed sites, which include 25 NHLs, 1 National Historic Site, 1 National Heritage Area, and 2 National Historic Trails (NPS, 2015a). Some State Historic Sites 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 Iowa may contain scenic or aesthetic areas considered visual resources or visually sensitive. There is one NHA in Iowa: Silos & Smokestacks National Heritage Area (Figure 6.1.8-1) (NPS, 2015b). Silos & Smokestacks NHA encompasses a 37 county area of Iowa and is "rich in the cultural history of farming and agribusiness, illustrates that mechanization made possible the American system of industrialized agriculture" (NPS, 2004).

National Historic Landmarks

NHLs are "nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States" (NPS, 2015c). 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 Iowa, there are 25 NHLs, including sites such as the Blood Run Site, Dubuque County Jail, Indian Village Site (Wittrock Area), Sergeant Floyd Monument, and James B. Weaver House (Figure 6.1.8-1) (NPS, 2015d). By comparison, there are over 2,500 NHLs in the United States (NPS, 2015n). Figure 6.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive.

National Historic Sites

Iowa has one National Historic Site, which is preserved by the NPS to "commemorate persons, events, and activities important in the nation's history" (NPS, 2003). The Herbert Hoover National Historic Site, is in West Branch, Iowa. (NPS, 2015e)**State Historic Sites and Parks**

Iowa's State Historic Preservation Office (SHPO) identifies, preserves, and protects the state's historic resources and administers the state's National Register of Historic Places as well as the state's inventory of historic properties (State Historical Society of Iowa, 2013a). In addition, the SHPO manages eight historic sites and one museum in partnership with "local historical societies and county conservation boards" (State Historical Society of Iowa, 2013b).

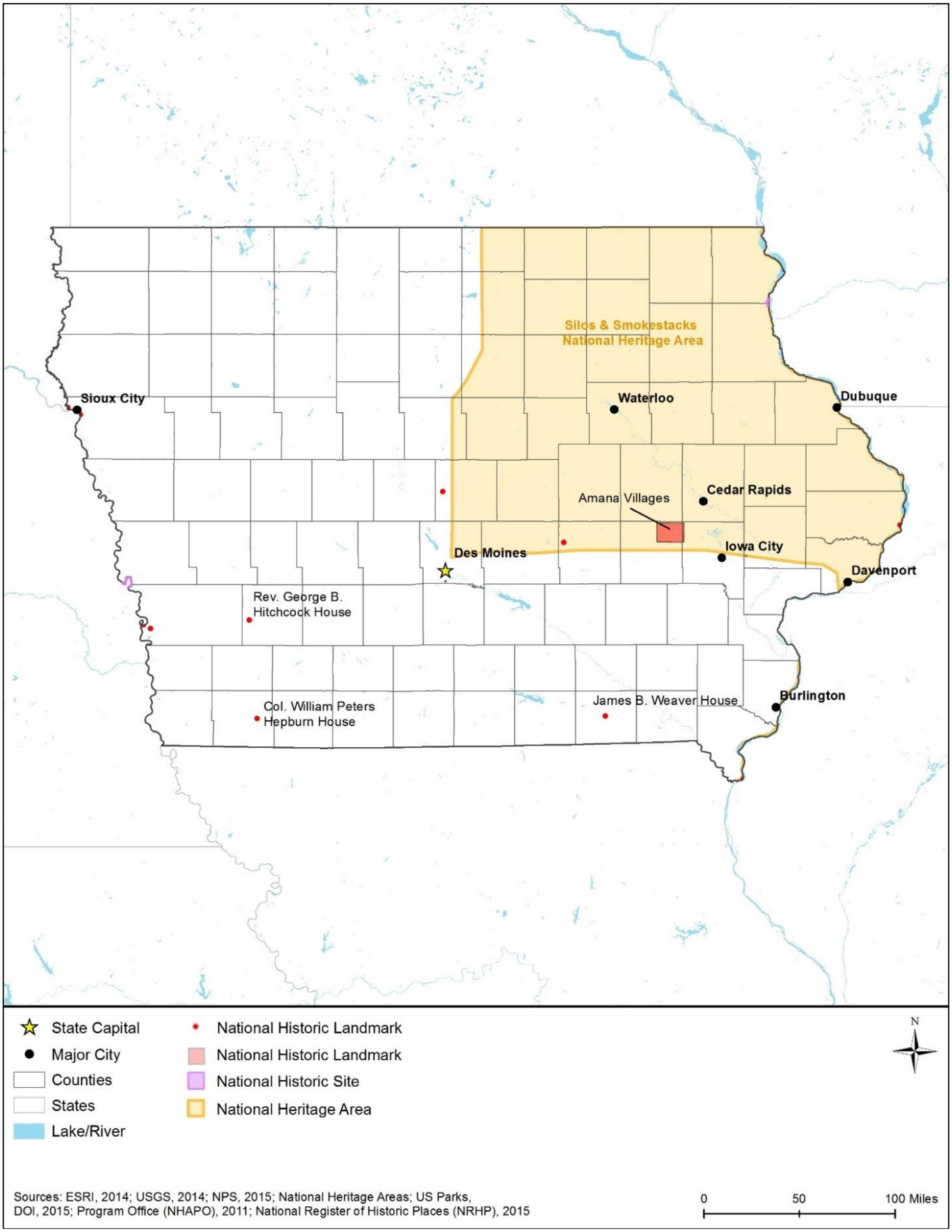


Figure 6.1.8-1: Representative Sample of Some Historic and Cultural Areas that May be Visually Sensitive

The eight sites and one museum are American Gothic House, Blood Run National Historic Landmark, Edel Blacksmith Shop, Gardner Cabin, Montauk, Plum Grove, Toolesboro Mounds National Historic Landmark, Western Historic Trails Center, and the State Historical Museum. Visual resources at these locations include burial mounds, prairie, original historic homes, and artifacts (State Historical Society of Iowa, 2013b).

6.1.8.5. Parks and Recreation Areas

Parks and recreation areas include state parks, state preserves, state forests, national parks, national recreation areas, national forests, national monuments, 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 6.1.8-3 identifies parks and recreational resources that may be visually sensitive in Iowa.[91] For additional information about recreation areas, including national and state parks, see Section 6.1.7, Land Use, Recreation, and Airspace.

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 Iowa, there are two[92] officially designated National Park Service Units, in addition to other NPS affiliated areas, such as National Heritage Areas. Iowa has one National Monument (see Figure 6.1.8-2), one National Historic Site, and two National Historic Trails (NPS, 2015f). Table 6.1.8-2 identifies the National Parks and affiliated areas located in Iowa. For additional information regarding parks and recreation areas, see Section 6.1.7, Land Use, Recreation, and Airspace.

Table 6.1.8-2: Iowa National Park Service Units

Area Name	
Effigy Mounds National Monument	Lewis & Clark National Historic Trail
Herbert Hoover National Historic Site	Mormon Pioneer National Historic Trail

Source: (NPS, 2015f)

[91] 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.

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

Source: (NPS, 2015g)

Figure 6.1.8-2: Effigy Mounds National Monument

National Monuments

NPS defines a national monument as a “nationally significant resource…smaller than a national park and [lacking]…diversity of attractions.” Iowa is home to one national monument managed by NPS: Effigy Mounds (see Table 6.1.8-2 and Figure 6.1.8-2) (NPS, 2015f). Effigy Mounds National Monument preserves the effigy mounds built by ancient American Indian cultures in the area as burial sites or markers of events or observances (NPS, 2015h).

U.S. Army Corps of Engineers Recreation Areas

There are seven USACE recreation and flood risk management areas within the state: Coralville Lake, Lake Red Rock, Mississippi River – Pools 9, 10, and 11-22, Rathbun Lake, and Saylorville Lake (see Figure 6.1.8-3) (U.S. Army Corps of Engineers, 2015). These lakes are specifically managed by the USACE for scenic and aesthetic qualities in their planning guidance in addition to managing risks for floods (U.S. Army Corps of Engineers, 1997).

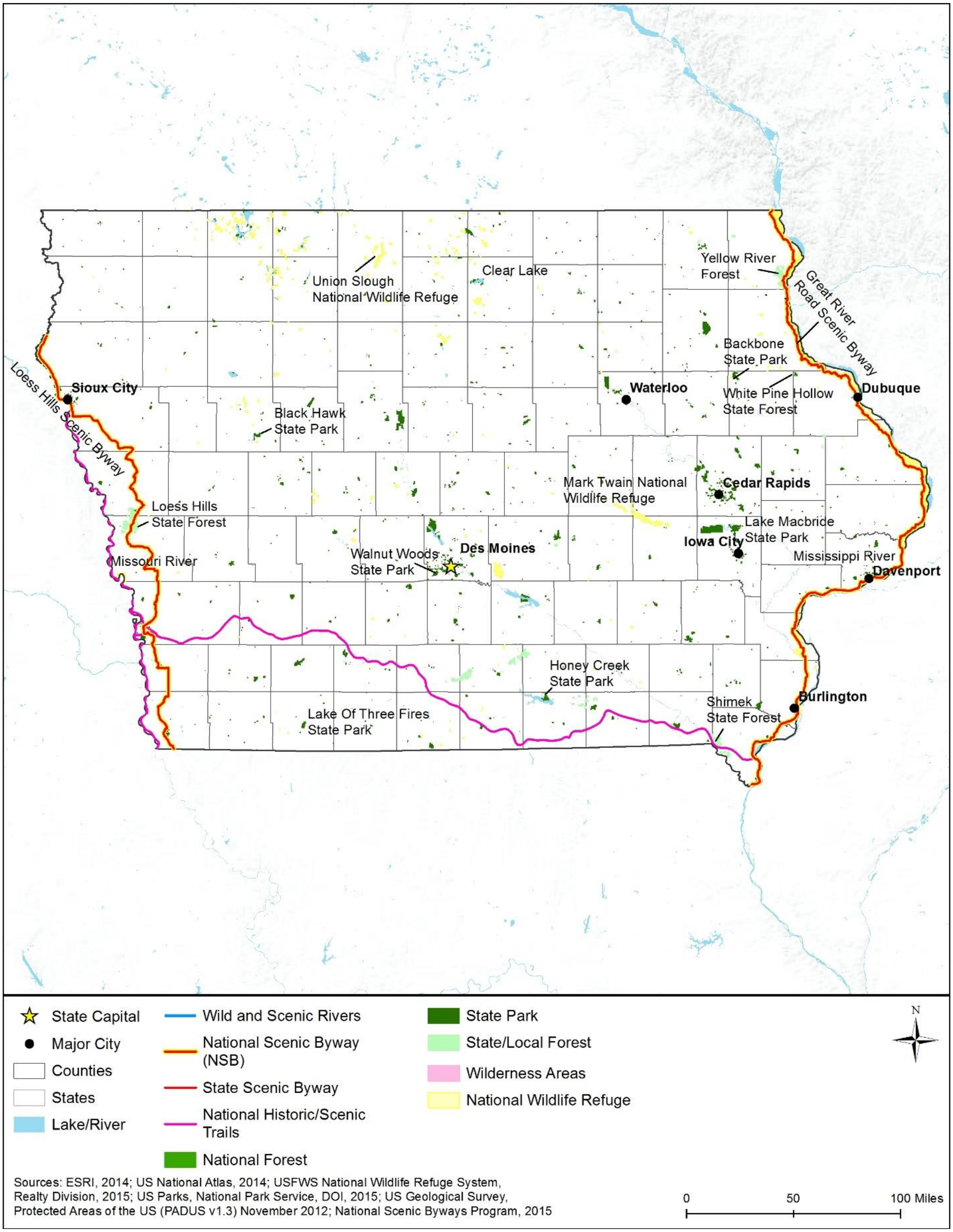


Figure 6.1.8-3: Natural Areas that May be Visually Sensitive

State and Federal Trails

The IDNR Trails Program maintains and builds recreational trails in the state's parks and forests "to cultivate human connection to the outdoors" (IDNR, 2015y). These trails have aesthetic resources such as oak and pine forests, ridges, hillsides, prairie remnants, loess hills, steep bluffs, open grass fields, and wildlife (IDNR, 2011b). For additional information about Iowa's trails, visit the 'Hiking & Biking in Iowa' on the IDNR website (IDNR, 2015aa).

The National Trails System Act defines National Historic Trails as "extended trails which follow as closely as possible and practicable the original trails or routes of travel of national historic significance" (NPS, 2012d). Two National Historic Trails pass through Iowa and surrounding states: Lewis and Clark National Historic Trail and the Mormon Pioneer National Historic Trail (Figure 6.1.8-3). The Lewis and Clark National Historic Trail recounts the expedition to find a route to the Pacific Ocean, and portions of it can be found in Iowa, as well as 10 other states (NPS, 2016c). The Mormon Pioneer National Historic Trail follows the "routes of mule pack trains from Santa Fe, New Mexico to Los Angeles, California" where horses and mules were exchanged for merchandise across six states for more than 1,400 miles (317 miles in Iowa).

In addition, the National Trails System Act authorized the designation of National Recreational Trails near urban areas by either the Secretaries of the Interior or Agriculture, depending upon the ownership of the designated land (American Trails, 2015b). In Iowa, there are 24 National Recreation Trails administered by the NPS, USACE, USFWS, local or state governments, and non-profit organizations (American Trails, 2015b).

State Parks

State parks contain natural, historic, cultural, and/or recreational resources of significance to Iowa residents and visitors. The IDNR's State Parks Bureau manages 72 state parks and recreation areas (see Figure 6.1.8-3), most of which contain scenic or aesthetic areas considered to be visual resources or visually sensitive (IDNR, 2015ab). Table 6.1.8-3 contains a sampling of state parks and their associated visual attributes. For a complete list of state parks, visit the IDNR's State Parks' website (IDNR, 2015ab).

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

State Park	Visual Attributes
Backbone State Park	Stone lodge, Backbone Lake, Devil's Backbone, Richmond Springs, rugged dolomite limestone cliffs, heavy woods, wildlife
Black Hawk State Park	Lake vistas, Black Hawk Lake, wildlife, forest, shrubs
Honey Creek State Park	Preserve golf course, rolling prairie, Rathbun Lake, rolling timbered hills, dam
Lake Macbride State Park	Lake Macbride, songbirds, beach, stone shelter
Walnut Woods State Park	Wooded bottomland, Raccoon River, wildflowers, wildlife

Source: (IDNR, 2015ab)

Source: (IDNR, 2015ac)

Figure 6.1.8-4: Pikes Peak State Park

State Forests

The IDNR manages a state forest system of four major and six minor forest units totaling 43,917 acres for multiple benefits including woodland management, forest products, wildlife habitat, and recreation (Table 6.1.8-4 and Figure 6.1.8-3). These forests contain visual resources such as oak and hickory trees, pine stands, savannas, prairies, Loess soils, white pine stands, wildlife, rare plants, deep sinks and caverns, limestone bedrock, and springs (IDNR, 2015ad).

Table 6.1.8-4: Iowa State Forests

State Forest Name	
Backbone State Forest	Pilot Mound State Forest
Barkley State Forest	Shimek State Forest
Gifford State Forest	Stephens State Forest
Holst State Forest	White Pine Hollow State Forest
Loess Hills State Forest	Yellow River State Forest

Source: (IDNR, 2015ad)

6.1.8.6. Natural Areas

National Wildlife Refuges and State Wildlife Management Areas

National Wildlife Refuges (NWRs) are a network of lands and waters managed by the USFWS. These lands and waters are "set aside for the conservation, management and, where appropriate, restoration of fish, wildlife, and plant resources and their habitats" (USFWS, 2015aa). There are seven NWRs in Iowa (USFWS, 2015ab) (Figure 6.1.8-3 and Table 6.1.8-5) including the Upper Mississippi NWR and the Driftless Area NWR. The Upper Mississippi NWR is comprised of approximately 240,000 acres and has been designated with global importance for wetlands and important bird areas. The Driftless Area NWR is comprised of 911 acres of the unique Driftless

Area of Iowa, covered in craggy, elevated landscape and home to rare plants and animals growing in the slopes (USFWS, 2015ac). Visual resources within this NWR include karst topography with steep slopes and cliffs void of glacial deposits found in the surrounding area (USFWS, 2015ac).

Table 6.1.8-5: Iowa National Wildlife Refuges

National Wildlife Refuge Name	
Boyer Chute NWR	Port Louisa NWR
Desoto NWR	Union Slough NWR
Driftless Area NWR	Upper Mississippi River NWFR
Neal Smith NWR	

Source: (USFWS, 2015ac)

The IDNR Wildlife Bureau manages over 356,000 acres of land statewide for public recreational use for hunting, fishing and trapping (IDNR, 2015ae). For additional information on wildlife refuges and management areas, see Section 6.1.6.4, Wildlife.

State Preserves and Natural Areas

The IDNR designates five categories of preserves: natural, geological, archaeological, historical, and scenic, for "permanent protection of significant natural and cultural features" (IDNR, 2015af). In total, IDNR administers 95 state preserves in the State Preserves System cooperatively with property owners and private conservation organizations. Visual resources in these areas include tallgrass prairie, gravelly hilltops, wet swales, marshes, upland forest, floodplain forest, forests gorge, bluffs, slump blocks, wildlife, and a variety of flora (IDNR, 2015af). Additionally, the USFWS, County Conservation Boards, The Nature Conservancy, and other private organizations manage 37 other conservation areas. The Nature Conservancy manages the Crossman Prairie, Mori Prairie, Red Cedar Woodlands, Swamp White Oak Preserve, and Buffalo Slough (The Nature Conservancy, 2015a). The Mori Prairie is a "rare example of black soil prairie" encompassing 40 acres of uncultivated agricultural soils and home to an uncommon plant community (The Nature Conservancy, 2015b).

National Natural Landmarks

National Natural Landmarks (NNLs) are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (NPS, 2014c). These landmarks may be considered visual resources or visually sensitive. In Iowa there are 7 NNLs (Table 6.1.8-6) (see Figure 6.1.8-3). Some of the natural features located within these areas include glacial pothole lakes, wind-blown sand, "loess," landscape, decorate caves, and remnant prairie (NPS, 2012b).

Table 6.1.8-6: Iowa National Natural Landmarks

National Natural Landmark Name	
Anderson Goose Lake	Hayden Prairie
Cayler Prairie	Loess Hills
Cold Water Cave	White Pine Hollow Preserve
Dewey’s Pasture and Smith’s Slough	

Source: (NPS, 2015i)

Source: (NPS, 2012c)

Figure 6.1.8-5: Loess Hills

6.1.8.7. Additional Areas

State and National Scenic Byways

National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. Iowa has two designated National Scenic Byways: Great River Road and Loess Hills Scenic Byway (see Figure 6.1.1-1). The Great River Road is 2,069 miles following the Mississippi River through the history of the cultures originating from its corridors. The Loess Hills Scenic Byway consists of 220 miles through the second highest “loess” hills in the world, bypassing state parks, preservers, national landmarks, and archaeological sites (FHWA, 2015d).

Similar to National Scenic Byways, the Iowa Department of Transportation administers state scenic byways that highlight the state’s scenic and historic resources. The Iowa Scenic Byways Program recognizes nine state scenic byways as noted in Table 6.1.8-7 and shown in Figure 6.1.8-3.

Table 6.1.8-7: Iowa State Scenic Byways

State Byway Name	
Delaware Crossing Scenic Byway	Iowa Valley Scenic Byway
Driftless Area Scenic Byway	Lincoln Highway Scenic Byway
Glacial Trail Scenic Byway	River Bluffs Scenic Byway
Grant Wood Scenic Byway	Western Skies Scenic Byway
Historic Hills Scenic Byway	

Source: (Iowa Byways, 2015)

6.1.9. Socioeconomics

6.1.9.1. Definition of the Resource

NEPA requires consideration of socioeconomics; specifically, Section 102(A) of NEPA requires federal agencies to "insure the integrated use of the natural and social sciences…in planning and in decision making" (42 U.S.C. §4332(A)). Socioeconomics refers to a broad, social science-based approach to understanding a region's social and economic conditions. It typically includes population, demographic descriptors, economic activity indicators, housing characteristics, property values, and public revenues and expenditures (U.S. Bureau Land Management, 2005). When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of FirstNet's Proposed Action, and in addition, FirstNet's Proposed Action 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 6.1.10).

Wherever possible, this section draws on nationwide datasets from Section 6.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: Land Use, Recreation, and Airspace (Section 6.1.7), infrastructure and public services (Section 6.1.1), and aesthetic considerations (Section 6.1.8), federal sources such as the U.S. Census Bureau (Census Bureau)[93] 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, these 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, 2016b).

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

6.1.9.2. Specific Regulatory Considerations

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

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

6.1.9.3. Communities and Populations

This section discusses the population and major communities of Iowa. It 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 6.1.9-1 presents the 2014 estimated population and population density of Iowa in comparison to the Central region[94] and the nation. The estimated population of Iowa in 2014 was 3,107,126. The population density was 56 persons per square mile (sq. mi.), which is lower than the population density of both the region (66 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Iowa was the 30th largest state by estimated population among the 50 states and the District of Columbia, 23rd largest by land area, and had the 37th greatest population density (U.S. Census Bureau, 2015v; U.S. Census Bureau, 2015w).

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

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
Iowa	55,857	3,107,126	56
Central Region	1,178,973	77,651,608	66
United States	3,531,905	318,857,056	90

Sources: (U.S. Census Bureau, 2015v; U.S. Census Bureau, 2015w)

Estimated population growth is an important subject for this PEIS, given that FirstNet's mission. Table 6.1.9-2 presents the population growth trends of Iowa from 2000 to 2014 in comparison to the Central region and the nation. The state's annual growth rate increased in the 2010 to 2014 period compared to 2000 to 2010, from 0.40 percent to 0.50 percent. The growth rate of Iowa in the 2010 to 2014 period was somewhat higher than the growth rate of the region, at 0.45 percent. Both geographies showed lower growth rates in both periods compared to the nation's growth rate (0.81 percent in 2010 to 2014).

[94] The Central region is comprised of the states of Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, 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 6.1.9-2: Recent Population Growth of Iowa

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
Iowa	2,926,324	3,046,355	3,107,126	120,031	60,771	0.40%	0.50%
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, 2015y; U.S. Census Bureau, 2015v)

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

Demographers prepare future estimated population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use estimated population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore, Table 6.1.9-3 presents projections of the 2030 population from two sources that are national in scope and use different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data, and analysis service (ProximityOne, 2015) (University of Virginia Weldon Cooper Center, 2015). The table provides figures for numerical change, percentage change, and annual growth rate based on averaging the projections from the two sources. The average projection indicates Iowa's estimated population will increase by approximately 188,000 people, or 6.1 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.37 percent, which is lower than the historical growth rate from 2010 to 2014 of 0.50 percent. The projected growth rate of the state is lower to that of the region (0.45 percent) and the nation (0.81 percent).

Table 6.1.9-3: Projected Estimated Population Growth of Iowa

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)[a] 2014 to 2030
Iowa	3,107,126	3,112,586	3,478,730	3,295,658	188,532	6.1%	0.37%
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, 2015v; UVA Weldon Cooper Center, 2015) (ProximityOne, 2015)

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

Population Distribution and Communities

Figure 6.1.9-1 presents the distribution and relative density of the estimated population of Iowa. 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, 2015d).

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. The map shows many such groupings in Iowa. Dispersed dots indicate dispersed population across the less densely settled areas of the state.

Table 6.1.9-4 provides the populations of the 10 largest population concentrations in Iowa, based on the 2010 census, and the changes in population for these areas between the 2000 and 2010 censuses.[95] In 2010, the largest population concentration was the Des Moines area, which had approximately 450,000 people. Iowa had five population concentrations between 100,000 and 500,000. All other population concentrations were less than 100,000. The smallest of these 10 population concentrations was the Iowa portion of the Burlington area, with a 2010 population of 29,544. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Iowa City area, with an annual growth rate of 2.26 percent.

The other areas with a growth rate over 1.00 percent were the Ames, Cedar Rapids, and Des Moines areas. The Burlington and Sioux City areas (Iowa portions) experienced population declines during this period.

Table 6.1.9-4 also shows that the top 10 population concentrations in Iowa accounted for 42.6 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 127.7 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.

[95] 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.

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

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)[a]
Ames	50,726	60,438	62,047	9	9,712	1.77%
Burlington (IA/IL) (IA Portion)	30,379	29,544	29,528	10	(835)	-0.28%
Cedar Rapids	155,334	177,844	180,259	2	22,510	1.36%
Davenport (IA/IL) (IA Portion)	131,672	142,901	145,205	3	11,229	0.82%
Des Moines	370,505	450,070	458,657	1	79,565	1.96%
Dubuque (IA/IL) (IA Portion)	62,330	64,767	65,312	8	2,437	0.38%
Iowa City	85,247	106,621	109,381	5	21,374	2.26%
Omaha (NE/IA) (IA Portion)	63,922	68,546	68,959	7	4,624	0.70%
Sioux City (IA/NE/SD) (IA Portion)	86,756	84,359	84,230	6	(2,397)	-0.28%
Waterloo	108,298	113,418	113,466	4	5,120	0.46%
Total for Top 10 Population Concentrations	**1,145,169**	**1,298,508**	**1,317,044**	**NA**	**153,339**	**1.26%**
Iowa (statewide)	**2,926,324**	**3,046,355**	**3,062,553**	**NA**	**120,031**	**0.40%**
Top 10 Total as Percentage of State	**39.1%**	**42.6%**	**43.0%**	**NA**	**127.7%**	**NA**

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

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

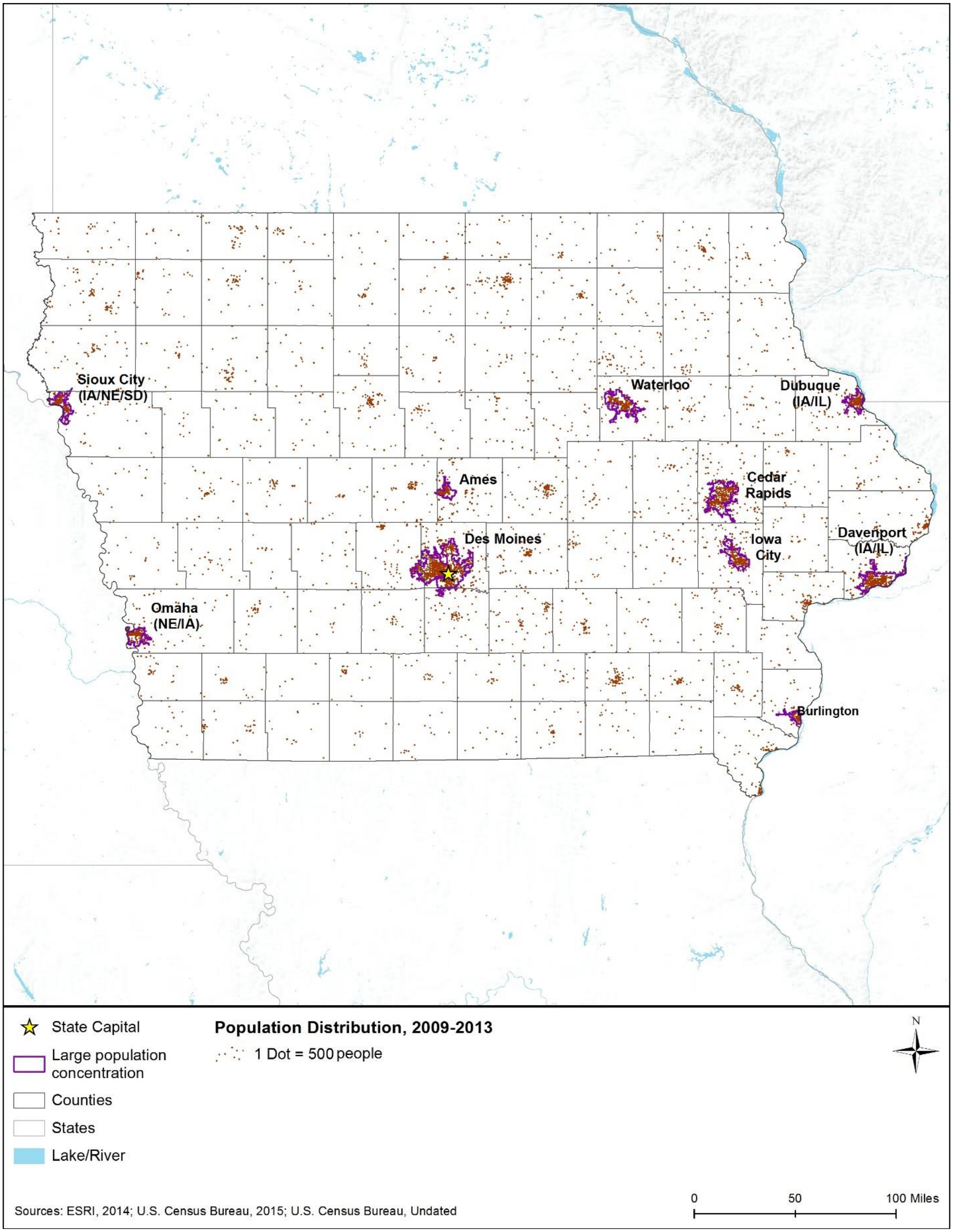


Figure 6.1.9-1: Estimated Population Distribution in Iowa, 2009–2013

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

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

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

Social institutions – educational, family, political, public service, military, and religious – are present throughout the state. The institutions most relevant to FirstNet's Proposed Action are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 6.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 6.1.9-5 compares several economic indicators for Iowa to the Central region and the nation. The table presents two indicators of income[96] – per capita and median household – as income is a good measure of general economic health of a region.

Per capita income is total income divided by the total population. As a mathematical average, the very high incomes of a relatively small number of people tend to bias per capita income figures upwards. Nonetheless, per capita income is useful as an indicator of the relative income level across two or more areas. As shown in Table 6.1.9-5, the per capita income in Iowa in 2013 ($27,740) was $212 higher than that of the region ($27,528), and $292 higher than that of the nation ($28,184) (Bureau of Labor Statistics, 2015b; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k), (U.S. Census Bureau, 2015i).

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 incomes, and half have lower income. Table 6.1.9-5 shows that in 2013, the MHI in Iowa ($52,286) was $241 higher than that of the region ($52,045), and $36 higher than that of the nation ($52,250) (Bureau of Labor Statistics, 2015b; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k); (U.S. Census Bureau, 2015i).

[96] 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." (Bureau of Labor Statistics, 2013a).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the unemployment rate as the number of unemployed individuals who are looking for work divided by the total number of individuals in the labor force. Table 6.1.9-5 compares the unemployment rate in Iowa to the east region and the nation. In 2014, Iowa's statewide unemployment rate of 4.4 percent was considerably lower than the rate for both the region (6.0 percent) and the nation (6.2 percent)[97] (Bureau of Labor Statistics, 2015b; U.S. Census Bureau, 2015j; U.S. Census Bureau, 2015k), (U.S. Census Bureau, 2015i).

Figure 6.1.9-2 and Figure 6.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015i) and unemployment in 2014 (Bureau of Labor Statistics, 2015f) varied by county across the state. These maps also incorporate the same population concentration data as Figure 6.1.9-1 (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015e). Following these two maps, Table 6.1.9-6 presents MHI and unemployment for the 10 largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to those on the maps. Nonetheless, both the maps and the table help portray differences in income and unemployment across Iowa.

Table 6.1.9-5: Selected Economic Indicators for Iowa

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Iowa	$27,740	$52,286	4.4%
Central Region	$27,528	$52,045	5.7%
United States	$28,184	$52,250	6.2%

Sources: (Bureau of Labor Statistics, 2015f; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015z; U.S. Census Bureau, 2015aa)

Figure 6.1.9-2 shows that counties with a MHI above the national median were distributed throughout the state; many were around the major population concentration areas but some were in less populated areas. Table 6.1.9-6 shows that MHI was lowest in the Iowa portion of Burlington and highest in the Des Moines area; they were also the smallest and largest of the areas shown in the table, respectively.

Figure 6.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that all counties in the state except for one in the Iowa's southeast corner (Lee County) had unemployment rates below the national average (that is, better employment performance). The northwestern portion of the state had a somewhat greater density of counties within the lowest range (less than 4.0 percent) of unemployment rates.

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

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

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

By industry, Iowa has a mixed economic base and some notable figures in the table are as follows. Iowa in 2013 had a higher percentage of persons working in "agriculture, forestry, fishing, and hunting, and mining" and "manufacturing," than did the region or the nation. It had a lower percentage of persons working in "arts, entertainment, and recreation, and accommodation and food services" and "professional, scientific, management, administrative, and waste management services" than the region or nation.

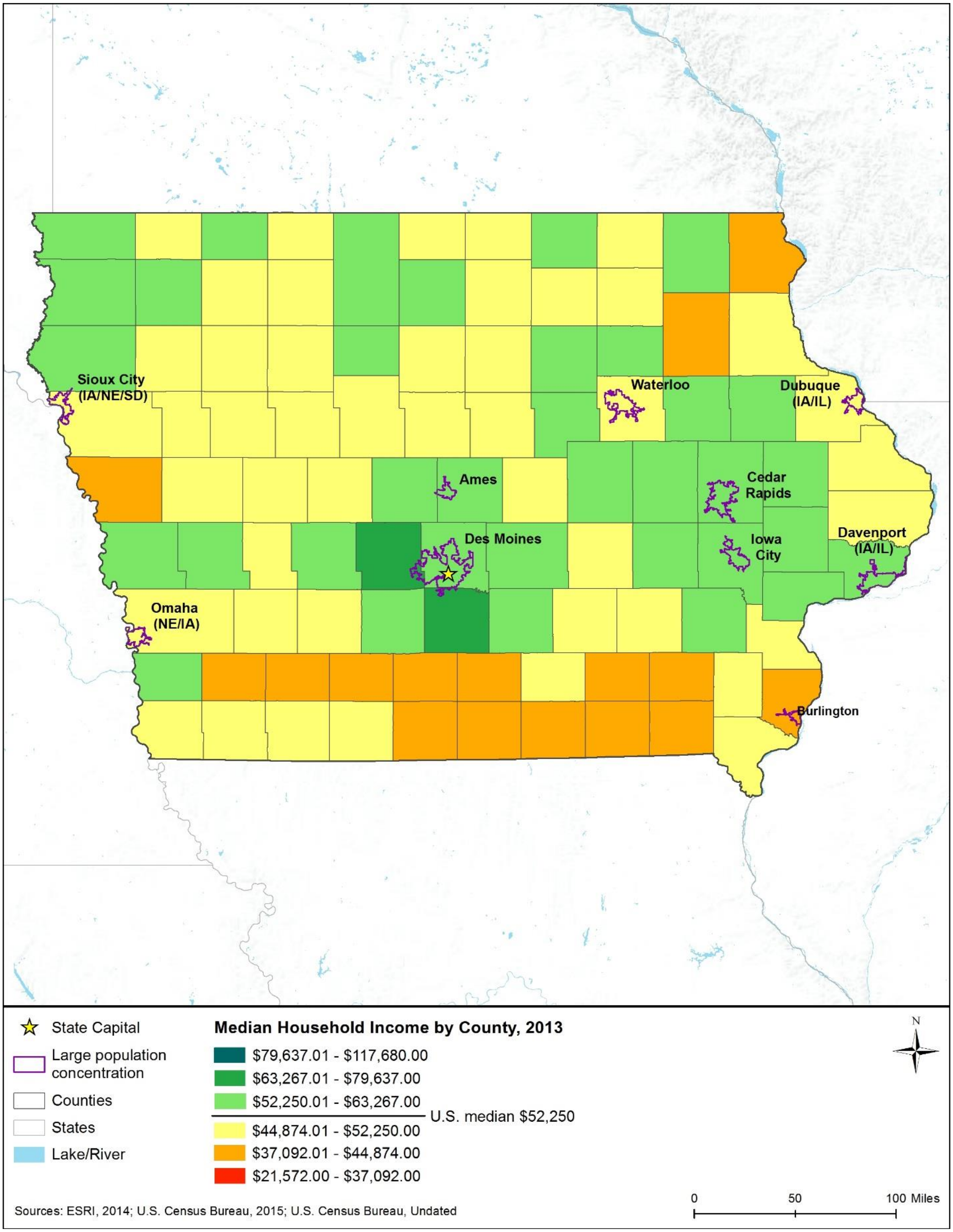


Figure 6.1.9-2: Median Household Income in Iowa, by County, 2013

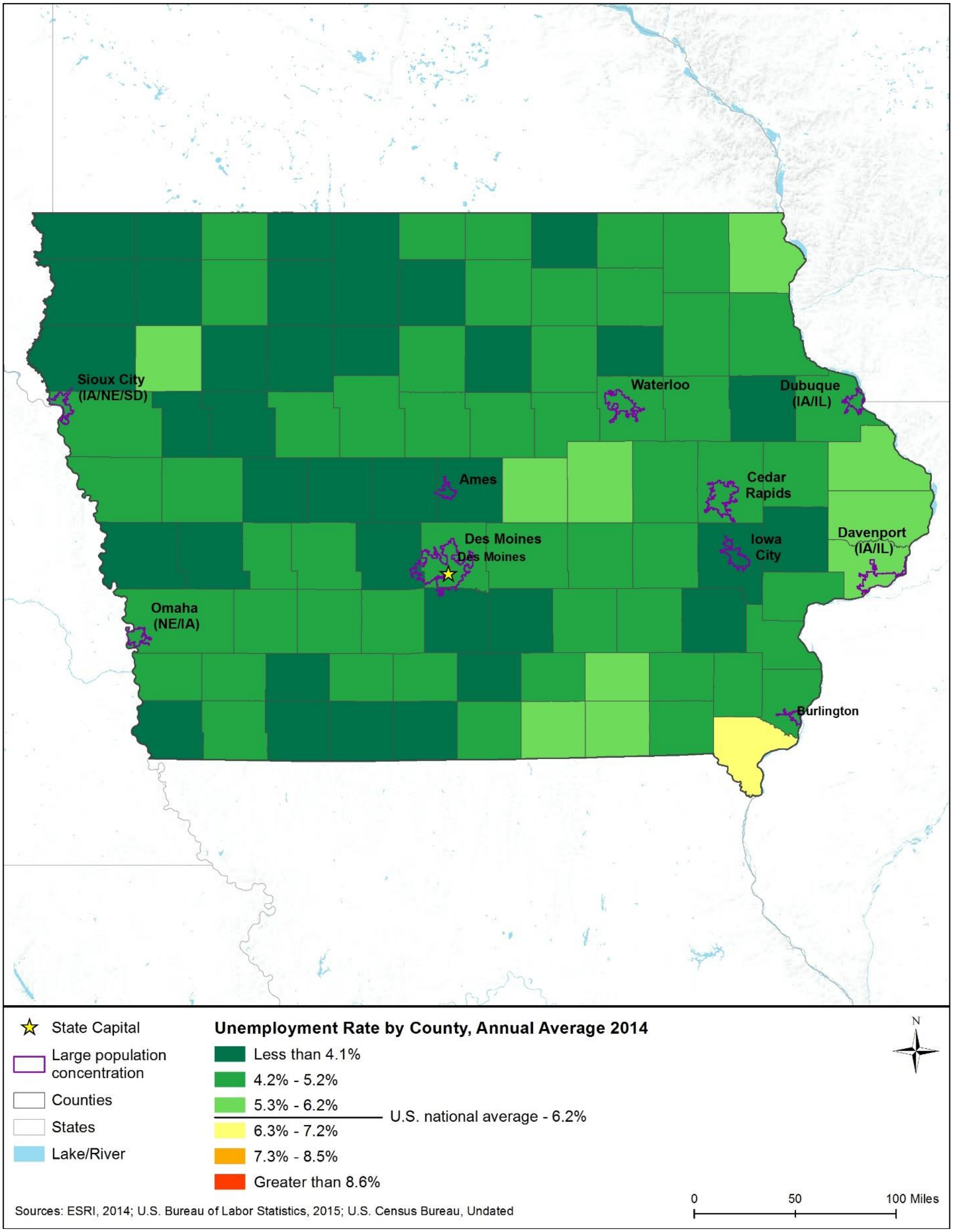


Figure 6.1.9-3: Unemployment Rates in Iowa, by County, 2014

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

Area	Median Household Income	Average Annual Unemployment Rate
Ames	$43,356	6.8%
Burlington (IA/IL) (IA Portion)	$38,943	10.0%
Cedar Rapids	$55,163	5.7%
Davenport (IA/IL) (IA Portion)	$50,839	6.2%
Des Moines	$60,392	6.0%
Dubuque (IA/IL) (IA Portion)	$47,116	5.8%
Iowa City	$48,751	4.6%
Omaha (NE/IA) (IA Portion)	$45,998	7.6%
Sioux City (IA/NE/SD) (IA Portion)	$43,889	5.8%
Waterloo	$43,311	8.6%
Iowa (statewide)	$51,843	5.8%

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

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

Class of Worker and Industry	Iowa	Central Region	United States
Civilian Employed Population 16 Years and Over	1,576,091	36,789,905	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	80.0%	81.7%	79.7%
Government workers	13.5%	12.8%	14.1%
Self-employed in own not incorporated business workers	6.3%	5.3%	6.0%
Unpaid family workers	0.1%	0.2%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	3.9%	2.2%	2.0%
Construction	6.0%	5.6%	6.2%
Manufacturing	15.5%	14.0%	10.5%
Wholesale trade	2.9%	2.7%	2.7%
Retail trade	11.5%	11.5%	11.6%
Transportation and warehousing, and utilities	4.5%	4.9%	4.9%
Information	1.7%	1.9%	2.1%
Finance and insurance, and real estate and rental and leasing	7.4%	6.5%	6.6%
Professional, scientific, management, administrative, and waste management services	7.1%	9.7%	11.1%
Educational services, and health care and social assistance	24.4%	23.4%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	7.7%	9.1%	9.7%
Other services, except public administration	4.2%	4.6%	5.0%
Public administration	3.3%	3.9%	4.7%

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

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

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

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Ames	3.4%	1.7%	2.0%	7.9%
Burlington (IA/IL) (IA Portion)	5.5%	5.0%	1.7%	5.7%
Cedar Rapids	5.4%	4.7%	3.1%	10.0%
Davenport (IA/IL) (IA Portion)	5.0%	5.1%	2.0%	8.0%
Des Moines	5.3%	3.8%	2.5%	10.1%
Dubuque (IA/IL) (IA Portion)	4.3%	2.9%	3.4%	8.1%
Iowa City	3.1%	2.8%	1.8%	7.9%
Omaha (NE/IA) (IA Portion)	7.2%	7.6%	1.7%	8.4%
Sioux City (IA/NE/SD) (IA Portion)	5.5%	4.3%	1.9%	8.3%
Waterloo	4.9%	4.1%	1.4%	6.9%
Iowa (statewide)	6.1%	4.6%	1.9%	7.0%

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

Housing

The housing stock is an important socioeconomic component of communities. The type, availability, and cost of housing in an area reflect economic conditions and affect quality of life. Table 6.1.9-9 compares Iowa to the Central region and nation on several common housing indicators.

As shown in Table 6.1.9-9, in 2013, Iowa had a higher percentage of housing units that were occupied (91.6 percent) than the region (88.4 percent) or nation (87.6 percent). Of the occupied units, Iowa had a higher percentage of owner-occupied units (70.8 percent) than the region (67.6 percent) or nation (63.5 percent). Similarly, it had a higher percentage of detached single-unit housing (also known as single-family homes) in 2013 (73.9 percent) compared to the region (67.7 percent) and nation (61.5 percent). The homeowner vacancy rate in Iowa (1.5 percent) was very similar to the rate for the region (1.8 percent) and the nation (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015h). The vacancy rate among rental units in Iowa (6.0 percent) matched the rate for the region and was very similar to the rate for the nation (6.5 percent).

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

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Iowa	1,349,607	91.6%	70.8%	1.5%	6.0%	73.9%
Central Region	33,580,411	88.4%	67.6%	1.8%	6.0%	67.7%
United States	132,808,137	87.6%	63.5%	1.9%	6.5%	61.5%

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

Table 6.1.9-10 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 6.1.9-10 shows that during this period the percent of occupied homes predominantly exceeded the state average of 91.5 percent, ranging between 96.2 percent in the Ames area to 90.9 percent in the Burlington, IA area.

Table 6.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Iowa, 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
Ames	24,642	96.2%	43.3%	1.3%	1.4%	40.5%
Burlington (IA/IL) (IA Portion)	13,877	90.9%	68.6%	1.9%	9.5%	74.6%
Cedar Rapids	79,961	92.4%	71.0%	2.1%	7.8%	63.4%
Davenport (IA/IL) (IA Portion)	63,119	92.7%	66.5%	2.1%	7.9%	66.2%
Des Moines	193,060	93.9%	69.0%	1.7%	4.5%	64.7%
Dubuque (IA/IL) (IA Portion)	28,104	94.5%	67.0%	0.5%	7.3%	64.4%
Iowa City	46,891	95.6%	54.4%	1.5%	2.6%	41.5%
Omaha (NE/IA) (IA Portion)	29,404	92.4%	66.2%	1.3%	10.0%	70.3%
Sioux City (IA/NE/SD) (IA Portion)	33,735	93.6%	64.3%	1.5%	5.7%	71.6%
Waterloo	48,335	93.4%	65.5%	2.3%	7.4%	65.9%
Iowa	1,341,001	91.5%	72.2%	1.8%	6.3%	74.0%

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

Property Values

Property values have important relationships to both the wealth and affordability of communities. Table 6.1.9-11 provides indicators of residential property values for Iowa 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 Iowa in 2013 ($126,900) was lower than the corresponding values for the Central region ($151,200) and the nation ($173,900).

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

Geography	Median Value of Owner-Occupied Units
Iowa	$126,900
Central Region	$151,200
United States	$173,900

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

Table 6.1.9-12 presents residential property values for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does show variation in property values for population concentrations across the state and compared to the state average for the 2009 to 2013 period. Only the Burlington (Iowa portion), Omaha (Iowa portion), Sioux City (Iowa portion), and Waterloo areas had median values lower than the state median value ($124,300). All other population concentrations had property values considerably above the state value, with the highest median property value in the Iowa City area ($178,500). The lowest value was in the Burlington area ($85,100), which also had the lowest median household income (Table 6.1.9-6).

Government Revenues

State and local governments obtain revenues from many sources. FirstNet may affect flows of revenue sources between different levels of government due to program financing and intergovernmental agreements for system development and operation. Public utility taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Bureau of Justice Statistics, 2011). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. These revenue streams are typically highly localized and therefore are best considered in the deployment phase of FirstNet.

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

Area	Median Value of Owner-Occupied Units
Ames	$172,200
Burlington (IA/IL) (IA Portion)	$85,100
Cedar Rapids	$139,400
Davenport (IA/IL) (IA Portion)	$138,400
Des Moines	$155,600
Dubuque (IA/IL) (IA Portion)	$137,300
Iowa City	$178,500
Omaha (NE/IA) (IA Portion)	$115,100
Sioux City (IA/NE/SD) (IA Portion)	$95,300
Waterloo	$119,300
Iowa (statewide)	$124,300

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

Table 6.1.9-13 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 6.1.9-13 shows that the state government in Iowa received more revenue in 2012 on a per capita basis than its counterpart governments in the region and nation. Additionally, the Iowa state government had a higher level of intergovernmental revenue[98] from the federal government. The Iowa state government obtained no revenue from property taxes. Local governments in Iowa had higher levels of property taxes per capita than local governments in the region and nation. General sales taxes were slightly higher on a per capita basis for the Iowa state government compared to its counterparts in the region and nation. The Iowa state government had slightly lower selective sales taxes compared to the region and nation. Public utility taxes, on a per capita basis, were higher for Iowa local governments than the counterparts in the region and nation. The Iowa state government did not report any public utility taxes. Individual and corporate income tax revenues, on a per capita basis, were higher for the Iowa state government and lower for Iowa local governments than for those governments in the region and nation.

[98] Intergovernmental revenues are those revenues received by one level of government from another level of government, such as shared taxes, grants, or loans and advances (U.S. Census Bureau, 2006).

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

Type of Revenue		Iowa		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	($M)	$21,080	$15,724	$463,192	$231,980	$1,907,027	$1,615,194
	Per capita	$6,857	$5,115	$6,020	$3,015	$6,075	$5,145
Intergovernmental from Federal	($M)	$6,073	$668	$125,394	$9,383	$514,139	$70,360
	Per capita	$1,976	$217	$1,630	$122	$1,638	$224
Intergovernmental from State	($M)	$0	$4,637	$0	$76,288	$0	$469,147
	Per capita	$0	$1,508	$0	$992	$0	$1,495
Intergovernmental from Local	($M)	$289	$0	$2,721	$0	$19,518	$0
	Per capita	$94	$0	$35	$0	$62	$0
Property Taxes	($M)	$0	$4,540	$3,626	$61,015	$13,111	$432,989
	Per capita	$0	$1,477	$47	$793	$42	$1,379
General Sales Taxes	($M)	$2,523	$691	$58,236	$6,920	$245,446	$69,350
	Per capita	$821	$225	$757	$90	$782	$221
Selective Sales Taxes	($M)	$1,110	$233	$33,313	$2,191	$133,098	$28,553
	Per capita	$361	$76	$433	$28	$424	$91
Public Utilities Taxes	($M)	$0	$190	$3,627	$1,153	$14,564	$14,105
	Per capita	$0	$62	$47	$15	$46	$45
Individual Income Taxes	($M)	$3,030	$97	$72,545	$5,148	$280,693	$26,642
	Per capita	$986	$32	$943	$67	$894	$85
Corporate Income Taxes	($M)	$426	$0	$9,649	$310	$41,821	$7,210
	Per capita	$139	$0	$125	$4	$133	$23

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

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

6.1.10. Environmental Justice

6.1.10.1. Definition of the Resource

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO (See Section 1.8.12, Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations). The fundamental principle of environmental justice is “fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (USEPA, 2016c). Under the EO, each federal agency must “make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Executive Office of the President, 1994). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (U.S. Department of Commerce, 2013).

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

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

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

6.1.10.2. Specific Regulatory Considerations

Iowa currently does not have a formal environmental justice policy for ensuring environmental equity for low income persons or racial minorities (University of California Hastings, 2010). However, House File 2393, "Minority Impact Statements," became law in 2008. Under this law, applicants for state agency grants must provide a minority impact statement that analyzes impacts on minority persons, explains the program or policy impacting minority persons, and provides evidence that representatives of the group had the opportunity to participate in the process (House Democratic Research Staff, 2008). Examples of grant programs requiring the minority impact statement include the Solid Waste Alternatives Program, Land and Water Conservation Fund, and Resource Enhancement and Protection Program (IDNR, 2016c) (IDNR, 2014a) (IDNR, 2014b).

6.1.10.3. Minority and Low-Income Populations

Table 6.1.10-1 presents 2013 data on the composition of Iowa's estimated population by race and by Hispanic origin. All of the state's minority races have the same or lower percentages of individuals compared to the Central region and the nation. The percentage of individuals identifying as Black/African American (3.3 percent) was considerably lower for the state compared to the region (9.3 percent) and the nation (12.6 percent). The state's estimated population of persons identifying as White (91.1 percent) was considerably higher than that of the Central region (82.2 percent) or the nation (73.7 percent).

The percentage of the estimated population in Iowa that identifies as Hispanic (5.4 percent) was lower compared to the Central region (8.5 percent) and much lower compared to 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. Iowa's All Minorities estimated population percentage (12.5 percent) was considerably lower than that of the Central region (23.3 percent) or the nation (37.6 percent).

Table 6.1.10-2 presents the percentage of the estimated population living in poverty in 2013, for the state, region, and nation. The figure for Iowa (12.7 percent) is considerably lower than that for the Central region (14.7 percent) and the nation (15.8 percent).

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

Geography	Total Estimated Population	Race							Hispanic	All Minorities[a]
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
Iowa	3,090,416	91.4%	3.3%	0.2%	2.1%	0.1%	1.2%	1.7%	5.4%	12.5%
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, 2015q)

[a] "All Minorities" is defined as all persons other than Non-Hispanic 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 6.1.10-2: Percentage of Estimated Population (Individuals) in Poverty, 2013

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

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

6.1.10.4. Environmental Justice Screening Results

Analysis of environmental justice in a NEPA document typically begins by identifying potential environmental justice populations in the project area. Appendix D, Environmental Justice Methodology, presents the methodology used in this PEIS to screen each state for the presence of potential environmental justice populations. The methodology builds on CEQ guidance and best practices 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 6.1.10-1 visually portrays the results of the environmental justice population screening analysis for Iowa. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015d; U.S. Census

Bureau, 2015s; U.S. Census Bureau, 2015t; U.S. Census Bureau, 2015u) and Census Bureau urban classification data (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015e).

Figure 6.1.10-1 shows that, in general, most of Iowa has low or moderate Potential for environmental justice populations. Areas with high potential for environmental justice populations are distributed fairly evenly across the state, and occur both within and outside of the 10 largest population concentrations.

It is important to understand how the data behind Figure 6.1.10-1 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 6.1.10-1 does not definitively identify environmental justice populations. It indicates *degrees of likelihood of the presence* of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. Block group data may under- or over-represent the presence of these localized communities. For instance, in the large block groups in sparsely populated regions of the state, these 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 significance criteria), and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (CEQ, 1997). Section 6.2, Environmental Consequences, addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

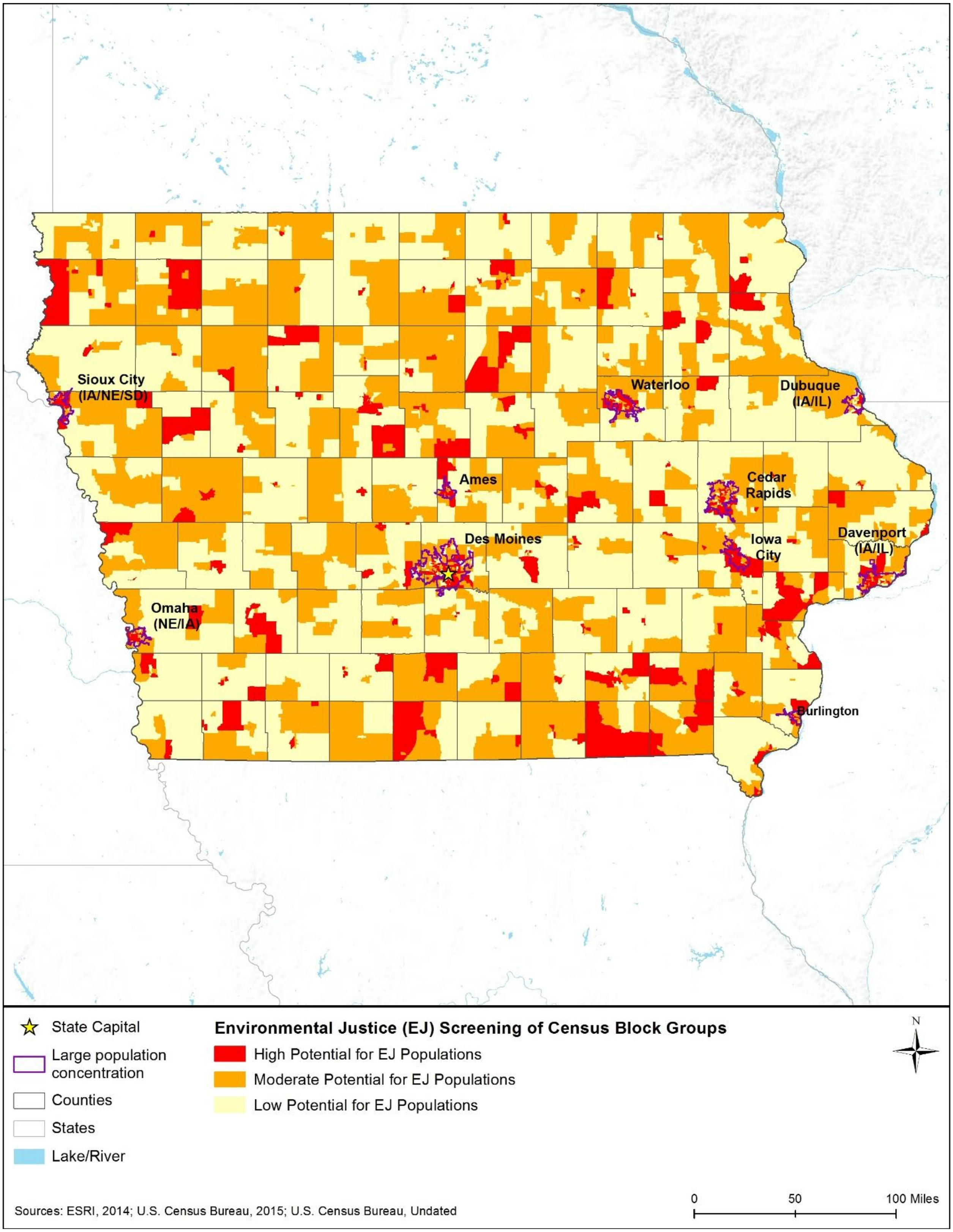


Figure 6.1.10-1: Potential for Environmental Justice Populations in Iowa, 2009–2013

6.1.11. Cultural Resources

6.1.11.1. Definition of Resource

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

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

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

- Statutory language and implementing regulations for Section 106 of the NHPA, as amended, formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- Statutory language and Implementing regulations for the Archaeological Resources Protection Act of 1979 (ARPA), 16 U.S.C. 470cc(c) and 43 CFR 7.3(a);
- Statutory language and implementing regulations for the Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3001(3)(D) and 43 CFR 10.2(d);
- NPS's program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources (NPS, 2015j); and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

6.1.11.2. Specific Regulatory Considerations

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

Iowa does not have state laws and regulations that are similar to the NHPA or NEPA. While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations. Table 6.1.8-1 presents state and local laws and regulations that relate to visual resources.

Table 6.1.11-1: Relevant Iowa Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
State Historical Society of Iowa (Iowa Code 303 § 4-35)	State Historical Division	Establishes the Historical Division of the Iowa Department of Cultural Affairs to administer historical sites, acquire historical sites, identify and document historic properties and prepare a state register of historic places; establishes the State Historical Society of Iowa
Iowa State Burial Site Statutes (Code of Iowa 263B.7-9, and Iowa Admin. Code 685-11.1 and 70-11-1)	State Archaeologist and local law enforcement	These laws prohibit the physical abuse or mistreatment of human remains, burials, grave markers, and associated objects. If a burial is uncovered during development or construction, work must stop immediately in the area and local law enforcement should be notified. Following determination that the site does not constitute a crime scene and the remains are a prehistoric or historic human burial, the State Archaeologist may assist the project proponent, developer, and/or landowner in contacting appropriate parties, considering options to avoid the burial(s), and advising on the legal process for potentially moving the remains.

Sources: (Iowa Department of Legislature, 2017d), (Iowa Department of Legislature, 2017g), (The University of Iowa, 2015a)

In addition to the state laws and regulations, in Iowa local jurisdictions have the authority to establish historic preservation programs to preserve historic and cultural resources, which may contain important visual resources (State Historical Society of Iowa, 2014).

6.1.11.3. Cultural Setting

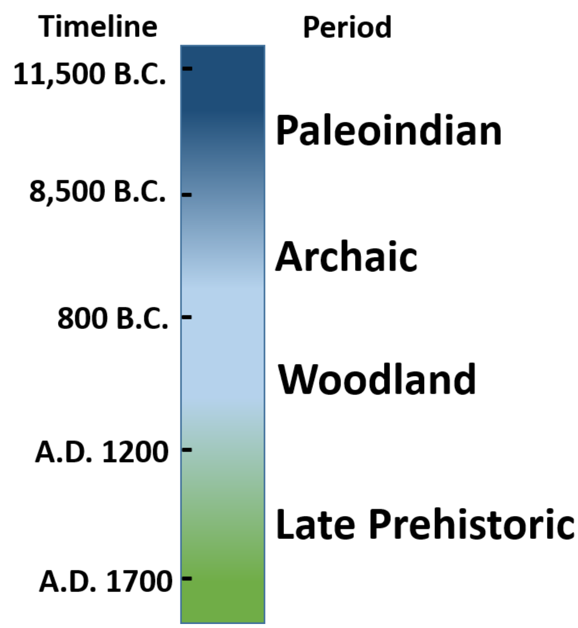
Human beings have inhabited the Iowa region for more than 13,500 years (Iowa State Historic Preservation Office, 2013). The majority of evidence of Iowa's early human habitation comes from the study of archeological sites of pre-European contact and historic populations. In addition to the hundreds of archaeological sites listed in the state's inventory, there are 33 archaeological sites in Iowa listed on the NRHP: 11 are historic, 20 are prehistoric, and 2 have both historic and prehistoric provenience (NPS, 2014d). Archaeologists typically divide large study areas into regions. As shown in Figure 6.1.3-1 in the Geology section for Iowa, the entire state occupies the physiographic region of the Interior Plains and the physiographic province Central Lowland.

Most archeological evidence in Iowa is found in relatively shallow deposits on the surface or within one to two feet of the surface. However, in some cases, natural factors have buried sites beneath multiple layers of sediment or organic materials, such as in floodplain deposits found along streams and rivers or peat deposits in wetlands. These alluvial deposits can range 1-10 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 (Association of Iowa Archaeologists, 2014; Iowa State Historic Preservation Office, 2013).

The following sections provide additional detail about Iowa's prehistoric periods (approximately 11500 B.C. to A.D. 1700) and the historic period since European contact began in the late 1600s. There is some overlap between the prehistoric period and the historic period, as American Indians continued to carry on their traditional way of life in parts of Iowa after European contact, because of its limited nature. Section 6.1.11.4 presents an overview of the initial human habitation in Iowa and the cultural development that occurred before European contact. Section 6.1.11.5 discusses the federally recognized American Indian Tribes with a cultural affiliation to the state. Section 6.14.6 provides a current list of significant archaeological sites in Iowa and tools that the state has developed to ensure their preservation. Section 6.1.11.7 documents the historic context of the state since European contact, and Section 6.14.8 summarizes the architectural context of the state during the historic period.

6.1.11.4. Prehistoric Setting

Archaeologists divide Iowa's prehistoric past into four periods: Paleoindian Period (10000 - 7000 B.C.), Archaic Period (7000 B.C. – A.D. 1), Woodland Period (A.D. 1 - 1000), and Late Prehistoric Period (A.D. 1000 – 1700). Figure 6.1.11-1 shows a timeline representing these periods of early human habitation of present day Iowa. Iowa is part of the Interior Plains archaeological culture of North America. Evidence of human occupation is prevalent in each of Iowa's physiographic regions. Due to advancements in archaeological techniques and the association of newly discovered artifacts with similar ones previously assigned to a particular range of the archaeological record, the dates associated with a particular phase in North American human development continue to become increasingly accurate (Pauketat, 2012; Haynes, Donahue, Jull, & Zabel, 1984; Haynes, Johnson, & Stafford, 1999).



Sources: (State Historical Society of Iowa, 2013c)

Figure 6.1.11-1: Timeline of Prehistoric Human Occupation

Paleoindian Period (10000 - 7000 B.C.)

The Paleoindian Period represents the earliest human habitation of the Iowa region. The earliest people lived in small groups of nomadic hunters and gatherers that used chipped-stone tools, including the "fluted javelin head" arrow and spear points (referred to as the Clovis or Folsom fluted point). Studies show that that such technology was prevalent in northeastern Asia, the Arabian Peninsula, and Spain prior to human arrival into North America (Charpentier & Inizan, 2002). During the Paleoindian period many large mammals that are now extinct, such as giant bison, mammoths, and ground sloths, were being hunted. As the technologies changed and the large animals decreased in numbers, the people began to exploit various other plant and animal species (Iowa State Historic Preservation Office, 2013).

Most of the oldest known evidence of human settlement in Iowa comes from the discovery of Clovis and Folsom fluted spear points. These artifacts from the Paleoindian Period are not distributed evenly throughout Iowa, and vary in accordance with geographic and topographic factors. Out of the 11,257 projectile points discovered in the United States dating from the Paleoindian period, only 135 were found in Iowa (Anderson & Faught, 1998). The majority of the fluted points documented in the United States are from east of the Mississippi River. Thirty-three of the Clovis and Folsom fluted points from Iowa have been discovered in the Loess Hills of the southwestern part of the state. Most of the points are broken, and were manufactured using locally sourced materials. A few points that were discovered intact were made from non-local materials (Billeck, 1998).

The Rummells-Maske archaeological site, in southwestern Cedar County in central Iowa, has provided some important evidence about the early Paleoindian occupation in this region. Artifacts collected at the site include at least 22 fluted points and a side scraper. Nine of the fluted points/knives are unbroken and intact. Archaeologists have determined that the majority of these artifacts were stored in caches at the site for future use. At least one of the artifact caches is believed to be associated with a burial, although no human remains were found (Morrow & Morrow, 2002).

Archaic Period (7000 B.C. – A.D. 1)

Bison remained a major part of the subsistence strategy for the people of the Archaic Period. It was previously thought that there was a major shift from this pattern, however, re-analysis of archaeological sites have revealed that bison continued to be hunted extensively throughout the early Archaic Period (Widga, 2004).

The lifestyle of the people began to change around 5,000 years ago. The domestication and cultivation of plants became an important supplement to the diet of the hunter and gatherer culture that continued to expand throughout the region (Dunne & Green, 1998). People began to settle into semi-permanent camps that they occupied depending upon the season and the availability of resources in an area. As populations continued to increase during the Archaic Period, the development of pottery for food storage and ceremonial purposes began about 3,000 years ago (Iowa State Historic Preservation Office, 2013). Archaeological evidence of ceramics manufacturing during the early Archaic Period is limited. In addition, the ceramics associated with the early Archaic Period are not related to those that were made later in the region during the Late Archaic and early Woodland Periods. Evidence suggests that Woodland Period pottery reflects the influence of various eastern and western United States cultures (Mehrer, 1998).

A late Archaic Period site known as Edgewater Park is situated along the Iowa River in Coralville, IA, and has provided some evidence of the lifestyle of the people from this period. The site is a small encampment with a two hearths that were used for cooking. A deep pit that archaeologists have not been able to determine the purpose for is also associated with the site. The site is thought to have been used as a seasonal camp along the Iowa River during the warmer months as a stop on the way to a winter seasonal camp. The Edgewater Park site is important because the botanical remains recovered there indicate that the people were cultivating non-local plants, suggesting that the people using the site carried the seeds with them for future planting. This site has provided evidence of the precursor to full-scale horticultural practices in the region (Whittaker, Dunne, Artz, Horgen, & Anderson, 2007).

Woodland Period (A.D. 1 - 1000)

During the early part of the Woodland Period, people primarily lived in seasonal camps much like their ancestors lived during the late Archaic, and the climate was much like the current conditions in Iowa. Although the people continued to hunt deer and bison during this period, they became very successful at harvesting fish and clams. Gardening increased in intensity during this period as native plants including gourds, sumpweed, goosefoot, sunflower, knotweed, little barley, and maygrass were being cultivated (The University of Iowa, 2015b). These practices eventually led to cultivation of corn and beans (Dunne & Green, 1998). The advent of the bow and arrow allowed for a more efficient means for hunting, warfare and possibly fishing (Iowa State Historic Preservation Office, 2013).

By the Middle Woodland period, sophisticated societies were formed, and evidence from this time of refined artwork, complex mortuary practices, and trading networks has been documented in the archaeological record. The societal structure associated with the people of this period is referred to as the Hopewellian culture. This culture was involved in sophisticated trade and exchange of exotic raw materials used for making tools. "Hopewell-related populations spread into Iowa from settlements along the Mississippi River, establishing small outposts at points along the major rivers in eastern Iowa, and may have ventured into southwestern Iowa from a Hopewellian center near Kansas City" (The University of Iowa, 2015b). The manufacturing of pottery became more sophisticated as evidence suggests from an archaeological site near Glenwood in southeast Iowa. It is hypothesized that the pottery from the Glenwood area was not an adaptation of the Hopewellian culture, rather it was adopted from types found in the Eastern Woodland region of the United States (Tiffany, 1978).

The practice of mound building was prevalent during the Woodland Period. One example of this cultural phenomenon comes from the discovery and excavation of four conical mounds in northeastern Iowa. These mounds are part of the Keller and Bluff Top mound groups, and date to the Late Woodland period. Artifacts discovered during the site investigation include pit features, rock layers, earthen fills, human remains, and other objects associated with ritual and burial practices (Benn, Bettis, & Mallam, 1993). The construction of both burial and ceremonial mounds became more elaborate throughout the Woodland and into the Late Prehistoric Periods (Iowa State Historic Preservation Office, 2013).

Late Prehistoric Period (A.D. 1000 – 1700)

Populations continued to increase during the Late Prehistoric Period as people became more sedentary. The evidence of gardening and the tools associate with such activity is prevalent within the central plains of Iowa. Permanent (or year-round) occupation of sites has been well documented (Ritterbush & Logan, 2000).

The Late Prehistoric period in Iowa is associated with the Plains culture of North America. Bison remained to be an important part of the subsistence strategy of these people. The bison served as tremendous food source throughout the Late Prehistoric Period (and through the late 19th century when they were nearly extinguished from the Interior Plains Region). As well as a food source, bison provided materials for shelters, clothing, containers, ritualistic practices, and other activities (Ritterbush, 2002).

Trade between the various populations throughout the region became a significant part of the cultural makeup. One particular item of importance in the economy was Florence-A chert,[99] which was a highly valued resource. As certain societies were not able to obtain Florence-A chert, the lack of this resource would have put them at a social disadvantage (Vehik, 1990).

6.1.11.5. Federally Recognized Tribes of Iowa

According to the Bureau of Indian Affairs and the National Conference of State Legislators, the Sac and Fox Tribe of the Mississippi in Iowa (Meskwaki Nation) is the only federally recognized tribe in Iowa (National Conference of State Legislators, 2015; U.S. Government Publishing Office, 2015). The general location of the tribes are shown in Figure 6.1.11-2. Additionally, the figure depicts the general historic location of officially federally recognized tribes that were known to exist in this region of the United States, but may no longer be present in the state.
Significant Archaeological Sites of Iowa

As previously mentioned in Section 6.1.11.3 there are 33 archaeological sites in Iowa listed on the NRHP. Table 6.1.11-2 lists the names of the sites, the city they are closest to, and type of site. The list includes both prehistoric and historic archaeological sites. The number of archaeological sites may increase with the discovery of new sites. A current list of NRHP sites are listed on the NPS NRHP website at http://www.nps.gov/nr/ (NPS, 2014e).

[99] Florence-A, Hardy Quarry, Maple City, or Kay County chert is a product that was traded widely over the southern Plains during the Late Prehistoric period. The chert (hard stone) has a distinctive quality and has been identified by archaeologists since the 1950s. It was first discovered and recognized as potential resource for prehistoric tool making in 1890 (Vehik, 1990).

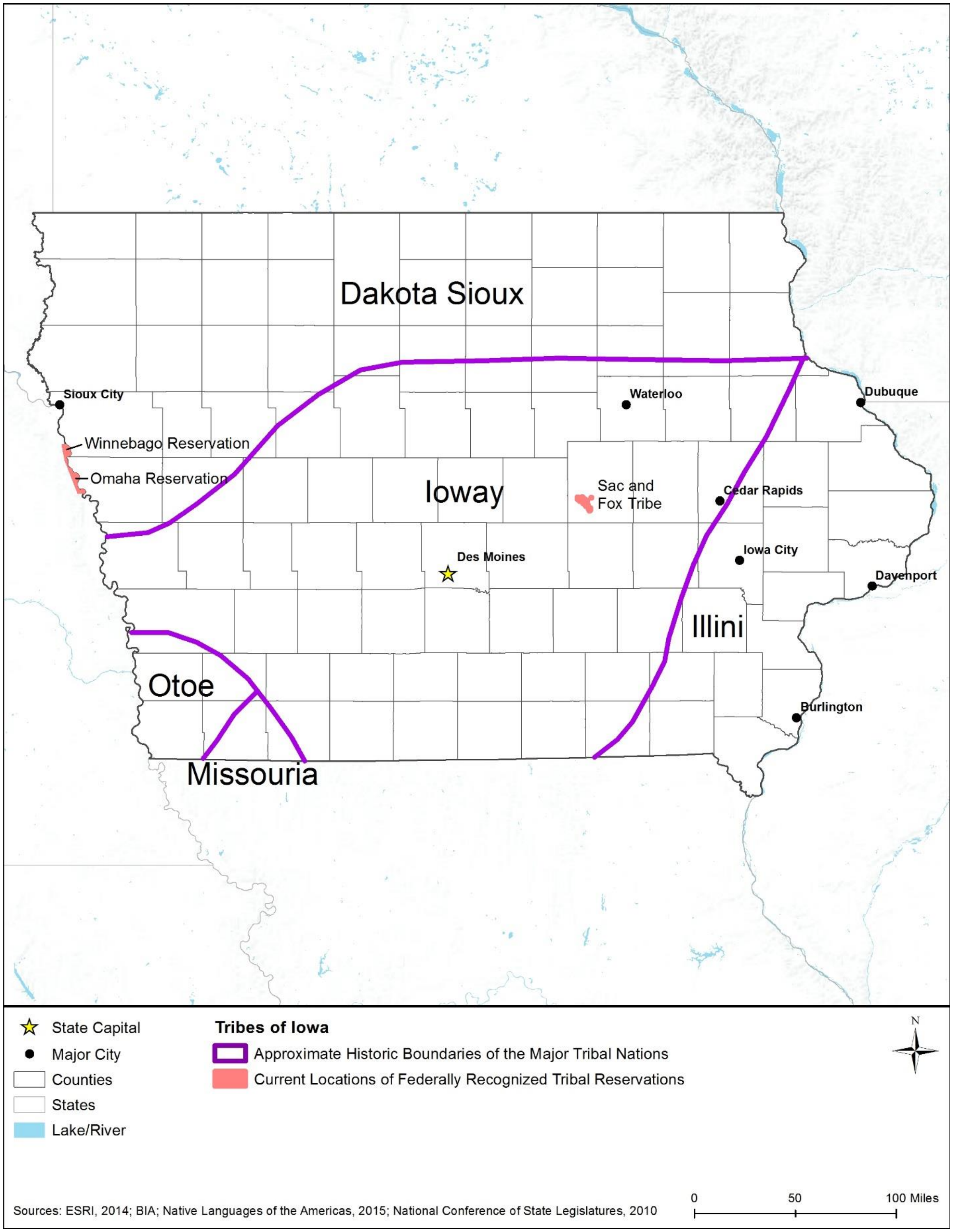


Figure 6.1.11-2: Approximate Historic Boundaries of Tribes in Iowa[100]

[100] Figure 6.1.11-2 is provided for context and is not intended to be exact as the various sources that were consulted contain varying ancestral territory boundaries. Instead, this figure and corresponding ancestral territory boundaries are provided to show that the historic ancestral territories and the current ancestral interests of a given tribe within a given state are often times complex as ancestral territory boundaries shifted and overlapped over time.

Table 6.1.11-2: Archaeological Sites on the National Register of Historic Places in Iowa

Closest City	Site Name	Type of Site
Alburnett	Notbohm Mill Archaeological District	Historic
Bonaparte	Bonaparte Pottery Archeological District	Historic
Cedar Rapids	Dewitt--Harman Archeological Site	Historic
Cherokee	Bastian Site	Prehistoric
Cherokee	Brewster Site	Prehistoric
Cherokee	Cherokee Sewer Site	Prehistoric
Cherokee	Phipps Site	Prehistoric
Dubuque	Dubuque Trading Post--Village of Kettle Chief Archeological District	Historic, Historic - Aboriginal
Dubuque	Four Mounds Estate Historic District	Prehistoric
Dubuque	Four Mounds Site	Prehistoric
Dubuque	Mines of Spain Area Rural Community Archeological District	Historic
Dubuque	Mines of Spain Lead Mining Community Archeological District	Historic
Dubuque	Mines of Spain Prehistoric District	Prehistoric
Fort Madison	Old Fort Madison Site	Historic, Military
Glenwood	Glenwood Archeological District	Prehistoric
Glenwood	West Oak Forest Earthlodge Site	Prehistoric
Hanover	Slinde Mound Group	Prehistoric
Klondike	Big Sioux Prehistoric Prairie Procurement System Archaeological District	Prehistoric
Linn Grove	Chan-Ya-Ta Site	Prehistoric
Lovilia	Buxton Historic Townsite	Historic - Aboriginal
Manchester	Spring Branch Butter Factory Site	Historic
Marquette	Effigy Mounds National Monument	Prehistoric
Middle Amana	Indian Fish Weir	Historic - Aboriginal, Prehistoric
Millville	Turkey River State Preserve Archeological District	Prehistoric
Mt. Vernon	Horecky, Henek and Mary, Log Cabin	Historic
New Albin	Fish Farm Mound Group	Prehistoric
Oakville	Florence-Council On The Iowa Site	Historic, Military
Sioux Falls	Blood Run Site	Historic - Aboriginal, Prehistoric
Smithland	Benson Archeological Site (13WD50)	Prehistoric
Steamboat Rock	Folkert Mound Group	Prehistoric
Sutherland	Indian Village Site	Prehistoric
Toolesboro	Toolesboro Mound Group	Prehistoric
Westfield	Kimball Village	Prehistoric

Source: (NPS, 2014e)

Historic Context

Present day Iowa was first explored in 1673 by Louis Joliet and Father Jacques Marquette as they traveled from Canada down the Mississippi River (Schwieder, 2015). In 1682, Rene Robert Cavelier, Sieur de La Salle claimed Iowa for France, which would claim control of the area until 1762 when it was transferred to Spain; Spain held the territory until it was transferred back to France in 1800. The United States acquired the land from France as a part of the Louisiana Purchase in 1803. Louis and Clark's Corps of Discovery explored parts of Iowa as it traveled along the Missouri River. Subsequent activity was largely restricted to trapping and exploration as the land still belonged to Indian groups until, in 1832, a treaty signed with the Sac (Sauk) and Fox Indians legally opened Iowa for western settlement (State Historical Society of Iowa, 2004).

Iowa State Cultural Resources Database and Tools

Iowa State Historic Preservation Office (SHPO)

The SHPO, which is part of the State Historical Society of Iowa, works to preserve the cultural resources of Iowa. The office is responsible for overseeing preservation programs and maintaining a significant amount of historical resources. A database is currently being developed to hold digital copies of items from the Iowa Site Inventory. Once complete, users will be able to access historic articles online free of charge. For now, requests can still be made via email at http://www.iowahistory.org/historic-preservation/ or phone to the inventory coordinator (State Historical Society of Iowa, 2013a).

University of Iowa—Office of State Archaeologist (OSA)

Iowa state law requires the existence of a State Archaeologist, which must be an anthropological faculty member at the University of Iowa. The OSA is a research department, which works to preserve and share regional history through research, education, and various service offerings. One of the responsibilities of the OSA is maintaining the Iowa Site File. The file contains all of the information on Iowa's cultural resources in a GIS format; this information is publicly accessible through the OSA website at http://archaeology.uiowa.edu/ (The University of Iowa, 2015c).

Association of Iowa Archaeologists

The Association of Iowa Archaeologists is a non-profit organization with the mission to aid in the preservation of state cultural resources. The Association provides a listing of consultants for users who require technical preservation assistance. Information can be accessed via their website at http://aiarchaeologist.org/ (Association of Iowa Archaeologists, 2014).

During the first half of the 19th century, Iowa switched between being a part of the Territory of Missouri, Territory of Michigan, and the Territory of Wisconsin, before the Territory of Iowa was created in 1838. In 1846, Iowa was admitted to the Union as the 29th state, and in 1857, the capital was moved to Des Moines. During the Civil War, the 75,000 soldiers from Iowa served in the Union army, and in 1867, the first railroad to cross the state was completed (State

Historical Society of Iowa, 2004). The railroad sparked the settlement of numerous towns along rail lines, while also allowing Iowa farmers to ship livestock and produce to larger markets like Chicago. Immigration increased following the Civil War, with settlers coming in large numbers from Germany, the Netherlands, Denmark, Sweden, and other European countries, as well as domestically from within the country (Schwieder, 2015).

While industries like coal mining and timber harvesting developed during the late 19th century when immigrants filled the need for labor, farming has traditionally dominated Iowa's economy. "In the countryside, by the 1920s five distinctive agricultural regions were evident: a northeastern dairy area; a north central cash-grain area; and three meat-producing areas—a western livestock region, southern pasture area, and eastern livestock region" (State Historical Society of Iowa, 2013c).

In 1917, the United States entered World War I (WWI), and the first U.S. causality of the war was a private from Glidden, Iowa. The economy boomed as production of goods from the state rose to meet wartime demands, resulting in employment opportunities (State Historical Society of Iowa, 2004). During the Great Depression, farmers suffered from dropping livestock and grain prices, before obtaining some relief through the New Deal programs in the 1930s. During World War II (WWII), farmers again experienced prosperity, as production once again rose to meet wartime demands. Today, "Iowa remains a state composed mostly of farms and small towns, with a limited number of larger cities" (Schwieder, 2015).

Iowa has 2,270 NRHP listed sites, as well as 25 NHLs (NPS, 2014f). Iowa contains one National Heritage Area, the Silos and Smokestacks National Heritage Area (NPS, 2015k). Figure 6.1.11-3 shows the location of NHA and NRHP sites within Iowa.[101]

[101] See Section 6.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

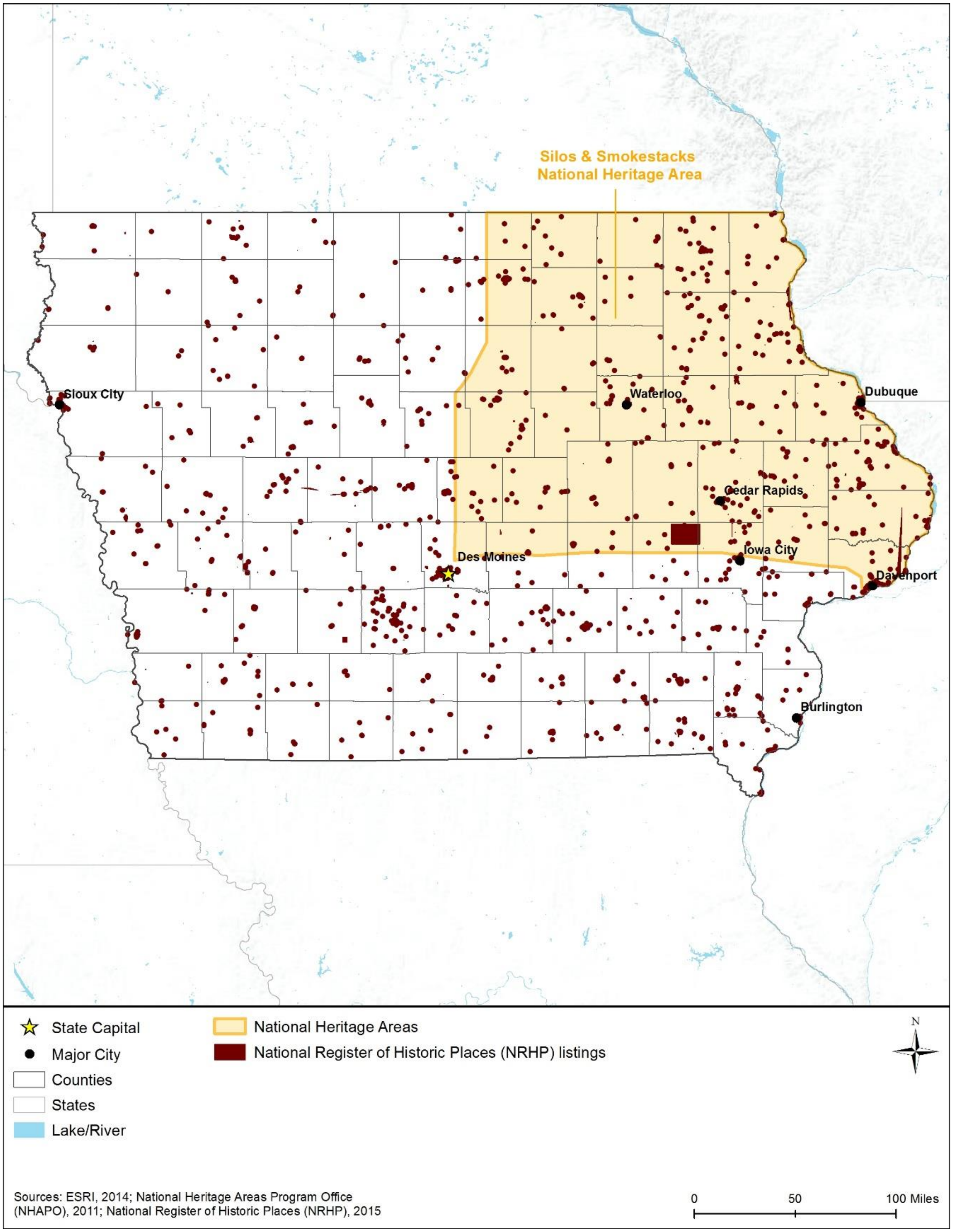


Figure 6.1.11-3: National Heritage Area (NHA) and National Register of Historic Places (NRHP) Sites in Iowa

6.1.11.6. Architectural Context

While simple structures of sod, log or stone were built early on—such as pioneer houses, trading posts, and military outposts—the majority of Iowa's historic resources date from the second half of the 19th century onward. "Situated in the western Midwest, Iowa came to express an architecture of a regional character that reflected designs popular during times of expansion—the 1850s, 1880s, 1896–1920, and post–World War II era" (State Historical Society of Iowa, 2013c). Greek Revival buildings exist, though perhaps less widespread than later styles, as the popularity of the style predated the widespread growth that occurred later in the 19th century. Picturesque styles like Gothic Revival and Italianate were popular starting in the 1840s and 1850s, with large quantities of Italianate building appearing during the railroad boom. Additional Victorian styles, such as Second Empire, Queen Anne, Stick, and Shingle were built during the late 19th century (State Historical Society of Iowa, 2013c).

Starting at the end of the 19th century and moving into the early 20th century, Neoclassical and Colonial Revival architecture became popular, with Colonial Revival lasting until the middle of the 20th century. Prairie Style houses were built during the first two decades of the 20th century, with bungalows gaining favor as well and being built until WWII. Modernist styles, including Art Deco, Art Moderne, and International were built during the second quarter of the 20th century as well (State Historical Society of Iowa, 2013c). Following WWII, minimal traditional houses were built, with ranch houses following during the mid-century years in the form of suburban automobile housing developments and commercial parks (McAlester, V., 2013). While some historically rural areas have been developed into suburban communities during the 20th century, an effort has been made to retain barns and other agricultural resources due to their importance to the state's history. Today, "Iowa stands a leader among states in the number of farms or barns listed in the National Register of Historic Places" (State Historical Society of Iowa, 2013c).

Railroad development was extremely important to Iowa, as the railroads allowed for farm goods and other resources to be shipped to larger markets. Numerous new towns were developed along rail lines, and historic resources from early railroad towns survive today. "The first town buildings were typically wood frame affairs. Few of the earliest survive—a small commercial building or pioneer's residence—connecting town residents to their beginnings. More common are places associated with the next generation of town development. Brick commercial buildings and the houses of prospering merchants" are examples of these types of resources (State Historical Society of Iowa, 2013c). Modern roads eventually surpassed the importance of railroads, "the best known route to travelers became the transcontinental Lincoln Highway… (which)…is the subject today of various preservation efforts and publicity" (State Historical Society of Iowa, 2013c). Later modern highways were accompanied by "new urban forms of office parks and its nearby restaurants, coffee houses, doughnut/bagel shops, superstores, and suburban-style neighborhoods" (State Historical Society of Iowa, 2013c).

Recreational facilities are another resource that expanded during the 20th century, in part with the help of New Deal work programs such as the Civilian Conservation Corps (CCC). The types of projects that were undertaken by CCC workers include recreation, administrative, and camping facilities, all of which employed a rustic style of architecture that was meant to fit in with the naturalistic setting of the parks (National Register of Historic Places, 1990). Institutional facilities, such as schools, courthouses, and post offices are important to Iowa history, as they were markers of the state progressing from an untamed frontier into mature statehood. "Iowa's historic schools illustrate what were the latest in educational trends and technological advances of the time," as well as a community's "shared history, community identity, and architectural legacy" (State Historical Society of Iowa, 2015).

Top Left – Rowland Gardner Log Cabin (Spirit Lake, IA) – (Historic American Buildings Survey, 1933a)
Top Middle – Iowa Capitol Building (Des Moines, IA) – (Highsmith, 1980)
Top Right – First Evangelical Lutheran Church (Sheldahl, IA) – (Historic American Buildings Survey, 1933b)
Bottom Left – Commercial and Industrial Buildings (Dubuque, IA) – (Historic American Buildings Survey, 1933c)
Bottom Right – Frank Chyle Jr. Barn (Protivin, IA) – (Historic American Buildings Survey, 1933d)

Figure 6.1.11-4: Representative Architectural Styles of Iowa

6.1.12. Air Quality

6.1.12.1. 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[102] 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)[103] or micrograms per cubic meter ($\mu g/m^3$)

[102] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[103] Equivalent to 1 milligram per liter (mg/L).

determined over various periods of time (averaging time).[104] This section discusses the existing air quality in Iowa. USEPA designates areas within the United States as attainment,[105] nonattainment,[106] maintenance,[107] or unclassifiable[108] 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.

Iowa has three separate and distinct air regulatory authorities, one that is responsible for air quality regulation in the state as a whole, and two that have delegated local authority: the IDNR – Air Quality Bureau, the Linn County Health Department Air Quality Division, and the Polk County Public Works Air Quality Division. These two local programs "have been given delegation by the DNR to conduct programs for the abatement, control, and prevention of air pollution in their respective count[ies]…Program emphasis is placed on the collection and assessment of information regarding air quality, the permitting or sources or air emissions, the enforcement of emission limits and the attainment and maintenance of ambient air quality standards" (IDNR, 2015am).

6.1.12.2. Specific Regulatory Considerations for the IDNR – Air Quality Bureau

National and State Ambient Air Quality Standards

The Clean Air Act (CAA) establishes National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: Carbon monoxide (CO), lead, oxides of nitrogen (NO_X), particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), and oxides of sulfur (SO_X). The NAAQS establish various standards, either primary[109] or secondary,[110] 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. Iowa has not established its own ambient air quality standards, and instead adopts the primary and secondary NAAQS (IDNR, 2013).

[104] 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, 2015o).
[105] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2014b).
[106] 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, 2014b).
[107] 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, 2014b).
[108] 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, 2014b).
[109] 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, 2014c).
[110] 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, 2014c).

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, 2016k). 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). The USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health.

Title V Operating Permits/State Operating Permits

Iowa 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, 2016e). The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (USEPA, 2015f). Title 567 IAC Chapter 22.103(455B) describes the applicability of Title V operating permits, and Chapter 22.1(1) outlines the requirements for state operating permits. Iowa requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 6.1.12-1). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014a).

Table 6.1.12-1: Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Pollutant	100
Single HAP	10
Total/Cumulative HAPs	**25**

Source: (USEPA, 2014a)

Exempt Activities

Under Title 567 IAC Chapter 22.1(2), the following select activities are not required to obtain a state operating permit:

- "Mobile internal combustion and jet engines…
- An internal combustion engine with a brake horsepower rating of less than 400 measured at the shaft, provided that the owner or operator meets all of the conditions in this paragraph. For the purposes of this exemption, the manufacturer's nameplate rated capacity at full load shall be defined as the brake horsepower output at the shaft. The owner or operator of an engine that was manufactured, ordered, modified or reconstructed after March 18, 2009, may use this exemption only if the owner or operator, prior to installing, modifying or reconstructing the engine, submits to the department a completed registration, on forms provided by the department, certifying that the engine is in compliance with the following federal regulations:

  - New source performance standards (NSPS) for stationary compression ignition internal combustion engines (40 CFR Part 60, Subpart IIII); or
  - New source performance standards (NSPS) for stationary spark ignition internal combustion engines (40 CFR Part 60, Subpart JJJJ); and
  - National emission standards for hazardous air pollutants (NESHAP) for reciprocating internal combustion engines (40 CFR Part 63, Subpart ZZZZ)…"
- Small units, emitting less than the amounts in Table 6.1.12-2.
- "…Direct-fired equipment burning natural gas, propane, or liquefied propane with a capacity of less than 10 million Btu per hour input, and direct-fired equipment burning fuel oil with a capacity of less than 1 million Btu per hour input, with emissions that are attributable only to the products of combustion…" (IDNR, 2015ah).

Table 6.1.12-2: Small Unit *De Minimis*[111] Levels

Pollutant	*De Minimis* levels
Lead and Lead Compounds	2 pounds per year
SO_2	5 tpy
NO_X	5 tpy
VOCs	5 tpy
CO	5 tpy
Particulate Matter	5 tpy
PM_{10}	2.5 tpy
$PM_{2.5}$	0.52 tpy
HAPs	5 tpy

Source: (IDNR, 2015ah)

Temporary Emissions Sources Permits

Iowa does not have regulations for temporary emission source permitting. Any temporary emission sources should review applicable construction and stationary source requirements, or contact the state for additional assistance.

State Preconstruction Permits

Title 567 IAC Chapter 22.1(3) requires "the owner or operator of a new or modified stationary source [to] apply for a construction permit" prior to beginning construction and operation of the emission source (IDNR, 2015ah).

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

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

evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and (e), federal actions "in response to emergencies which are typically commenced on the order of hours or days after the emergency" and actions "which are part of part of a continuing response to emergency or disaster" that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (U.S. Government Publishing Office, 2010).

The estimated pollutant emissions are compared to *de minimis* levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 6.1.12-3). As a result, lower *de minimis* thresholds for VOCs and NO_X could apply depending on the attainment status of a county.

Table 6.1.12-3: De Minimis Levels

Pollutant	Area Type	TPY
Ozone (VOC or NO_X)	Serious Nonattainment	50
	Severe Nonattainment	25
	Extreme Nonattainment	10
	Other areas outside an OTR	100
Ozone (NO_X)	Maintenance	100
Ozone (VOC)	Maintenance outside an OTR	100
CO, SO_2, NO_2	All Nonattainment and Maintenance	100
PM_{10}	Serious Nonattainment	70
	Moderate Nonattainment and Maintenance	100
$PM_{2.5}$ (Direct Emissions) (SO_2) (NO_X (unless determined not to be a significant precursor)) (VOC or ammonia (if determined to be significant precursors))	All Nonattainment and Maintenance	100
Lead	All Nonattainment and Maintenance	25

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

If an action does not result in an emissions increase above the *de minimis* levels in Table 6.1.12-3, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 6.1.12-3, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS.

To demonstrate conformity,[112] 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;

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

- 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, 2010b).

State Implementation Plan Requirements

The Iowa SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Iowa's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Iowa's SIP actions are codified under 40 CFR Part 52 Subpart Q. A list of all SIP actions for all six criteria pollutants can be found on the IDNR Air Quality Bureau website http://www.iowadnr.gov/Environmental-Protection/Air-Quality/Implementation-Plans.

6.1.12.3. Specific Regulatory Considerations for Linn County Health Department Air Quality Division

National and State Ambient Air Quality Standards

Linn County has not established its own ambient air quality standards, and instead adopts the primary and secondary NAAQS (Linn County Health Department, 2015a).

Title V Operating Permits/State Operating Permits

Linn County manages the Title V "permitting and enforcement process [of major sources] for the IDNR. However, the Iowa DNR issues all Title V permits in Linn County and there all rules, policies, application materials issued by the Iowa DNR are used" (Linn County Health Department, 2015b). Under Chapter 10.4 of the Linn County Code of Ordinances, the Health Department adopts IDNR requirements for Title V permits in Title 567 IAC Chapter 22 (Linn County Health Department, 2015a).

Pursuant to Chapter 10.5(3) of the Linn County Code of Ordinances, local Permits to Operate are issued by the Air Pollution Control Officer for "any article, machine, equipment or other contrivance which when used may cause the creation or emission of air contaminants." (Linn County Health Department, 2015a)

Exempt Activities

Under Linn County Code of Ordinances, Chapter 10.5(9), the following select activities are exempt from the requirements of Authorization to Install Permits and Permits to Operate:

- "Mobile internal combustion and jet engines…
- Stationary internal combustion engines with a brake horsepower rating of less than 400 or a kilowatt output less than 300…" (Linn County Health Department, 2015a).

Temporary Emissions Sources Permits

Linn County does not have regulations for temporary emission source permitting. Potential operators of any temporary emission sources must review applicable construction and stationary source requirements, or contact the Health Department Air Quality Division for additional assistance.

State Preconstruction Permits

Pursuant to Chapter 10.5(2) of the Linn County Code of Ordinance, "a permit for authorization to install for new facilities must be obtained prior to the initiation of construction, installation or alteration of any portion of the stationary source." (Linn County Health Department, 2015a)

General Conformity

Linn County has not established its own General Conformity requirements. See Section 6.1.12.2 for a general discussion of the Federal General Conformity laws used by IDNR.

State Implementation Plan Requirements

Linn County is attainment for all criteria pollutants and therefore does not require a SIP.

6.1.12.4. Specific Regulatory Considerations for Polk County Public Works Air Quality Division

National and State Ambient Air Quality Standards

Polk County has not established its own ambient air quality standards, and instead adopts the primary and secondary NAAQS (Polk County Board of Health Rules and Regulations, 2011).

Title V Operating Permits/State Operating Permits

Polk County requires all new and existing equipment operators to obtain permits before beginning operation. If required to obtain a Title V operating permit, the owner of a major source "may instead choose to obtain a conditional operating permit following successful demonstration of the following:

- That the potential to emit of each pollutant subject to regulation shall be limited to less than 100 tons per 12-month rolling period;
- That the actual emissions of each pollutant subject to regulation, including fugitive emissions, has been and is predicted to be less than 100 tons per 12-month rolling period;
- That the potential to emit of each regulated hazardous air pollutant shall be less than 10 tons per 12-month rolling period and the potential to emit of all regulated hazardous air pollutants shall be less than 25 tons per 12-month rolling period; and
- That the actual emissions of each regulated hazardous air pollutant, including fugitives, has been and is predicted to be less than 10 tons per 12-month rolling period and the actual emissions of all regulated hazardous air pollutants has been and is predicted to be less than 25 tons per 12-month rolling period…" (Polk County Board of Health Rules and Regulations, 2011).

Exempt Activities

Under Polk County Board of Health Rules and Regulations Chapter 5-33 and 5-39, the following select activities are exempt from obtaining construction and operating permits:

- "Mobile internal combustion engines and jet engines…
- Portable equipment previously permitted by the Iowa Department of Natural Resources…
- An internal combustion engine burning exclusively natural gas with a brake horsepower rating of less than 100 measured at the shaft…" (Polk County Board of Health Rules and Regulations, 2011).

Temporary Emissions Sources Permits

As indicated in the Polk County Board of Health Rules and Regulations Chapter 5-35(d), portable equipment is permitted through local operating permits. Any portable equipment operated within Polk County will go through the operating permit process outlined in Chapter 5-36, and will notify the Polk County health officer "…at least 14 days prior to the transfer of the portable equipment to the new location" (Polk County Board of Health Rules and Regulations, 2011).

State Preconstruction Permits

Pursuant to Chapter 5-28 of the Polk County Board of Health Rules and Regulations, all sources must obtain a construction permit before constructing, installing, reconstructing, or altering any equipment. However, "new, reconstructed, or modified sources may initiate construction prior to issuance of the construction permit if they meet the" following requirements:

- A construction permit application has already been submitted to the Air Quality division;
- At least five days prior to initiating construction, the Health Officer is notified of the intentions to commence construction; and
- The source does not meet the requirements for Prevention of Significant Deterioration.

The construction permit must be received prior to commencing operation of the source (Polk County Board of Health Rules and Regulations, 2011).

General Conformity

Polk County has not established its own General Conformity requirements. See Section 6.1.12.2 for a general discussion of the federal General Conformity laws used by IDNR.

State Implementation Plan Requirements

Polk County is attainment for all criteria pollutants and therefore does not require a SIP.

6.1.12.5. Ambient Air Quality

Nonattainment Areas

The USEPA classifies areas as attainment, nonattainment, maintenance, or unclassifiable for six criteria pollutants. When evaluating an area's air quality against regulatory thresholds (i.e., permitting and general conformity), maintenance areas are often combined with nonattainment, while unclassifiable areas are combined with attainment areas. Figure 6.1.12-1 and Table 6.1.12-4, below, present the nonattainment areas in Iowa as of January 30, 2015. The year(s) listed in the table for each pollutant indicate when USEPA promulgated the standard for that pollutant; note that, for Lead, $PM_{2.5}$, O_3, and SO_2, these standards listed are in effect. Unlike Table 6.1.12-4, Figure 6.1.12-1 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 6.1.12-4: Iowa Nonattainment and Maintenance Areas by Pollutant Standard and County

County	Pollutant and Year USEPA Implanted Standard										
	CO	Lead		NO_2	PM_{10}	$PM_{2.5}$		O_3		SO_2	
	1971	1978	2008	1971	1987	1997	2006	1997	2008	1971	2010
Muscatine										M	X-6
Pottawattamie			X-6								

Source: (USEPA, 2015g)

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

Air Quality Monitoring and Reporting

The IDNR with support from the Iowa Hygienic Laboratory, the Linn County Public Health Department, and the Polk County Public Works Air Quality Division, measures air pollutants at 37 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Annual Iowa State Ambient Air Quality Reports are prepared with pollutant data summarized by region. The IDNR provides links to national and local real-time feeds of air quality indices and pollutant concentrations on their website (http://www.iowadnr.gov/Environmental-Protection/Air-Quality/Monitoring-Ambient-Air).

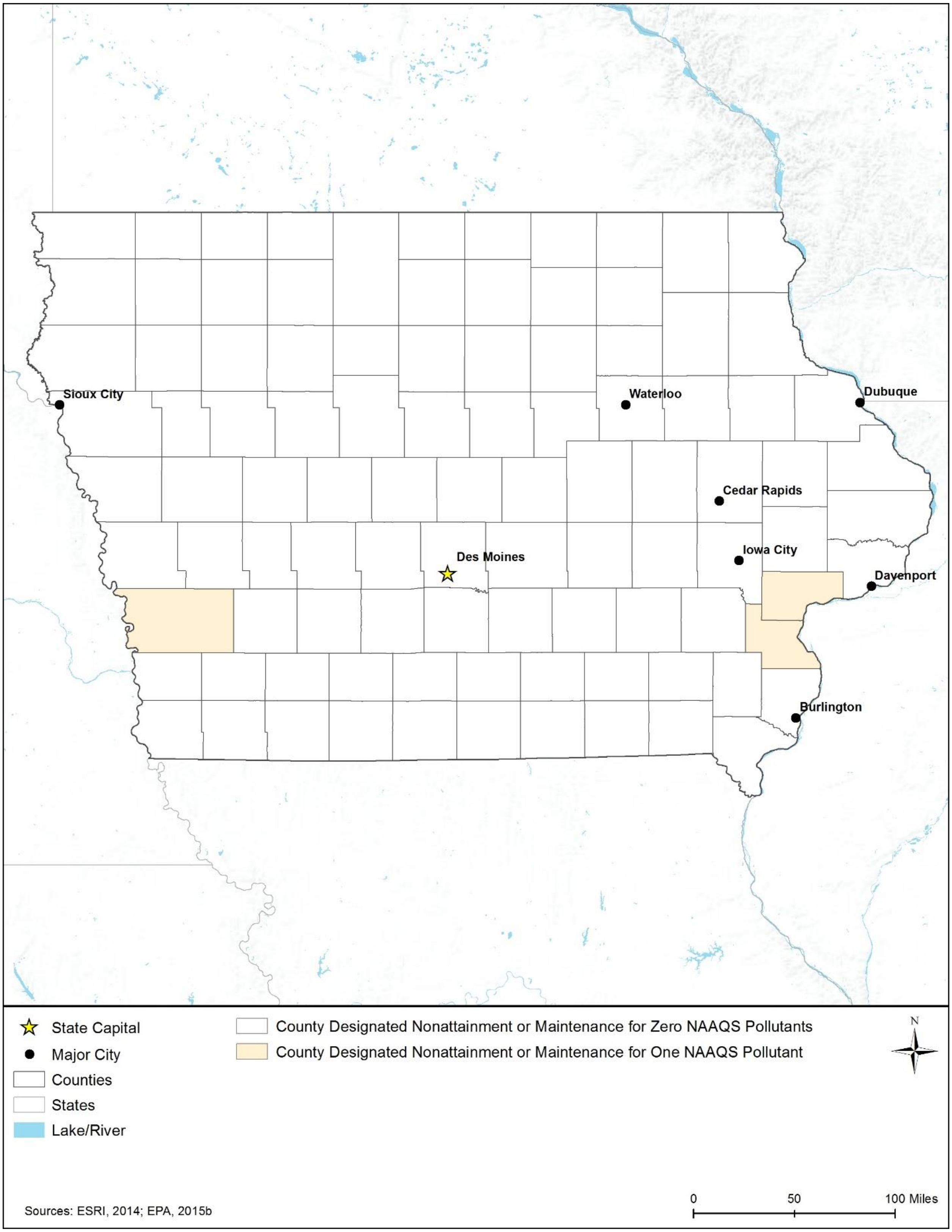


Figure 6.1.12-1: Nonattainment and Maintenance Counties in Iowa

Throughout 2014 (Table 6.1.12-5), "there were 91 NAAQS exceedances in the state of Iowa. Fifteen of the exceedances were associated with the 24-hour $PM_{2.5}$ standard and 76 were exceedances of the 1-hour [SO_2] standard." (IDNR, 2014c)

Table 6.1.12-5: Iowa NAAQS Exceedances in 2014

Pollutant	County	Number of Exceedances
$PM_{2.5}$	Pottawattamie	1
	Woodbury	2
	Montgomery	1
	Linn	1
	Clinton	2
	Scott	3
	Muscatine	5
SO_2	Linn	10
	Muscatine	66

Source: (IDNR, 2014c)

Air Quality Control Regions

USEPA classified all land in the United States as a Class I, Class II, or Class III Federal Air Quality Control Region (AQCR) (42 U.S.C. §7470). Class I areas include international parks, national wilderness areas which exceed 5,000 acres in size, national memorial parks which exceed 5,000 acres in size, and national parks which exceed 6,000 acres in size. Class I areas cannot be re-designated as Class II or Class III and are intended to maintain pristine air quality. Although USEPA developed the standards for a Class III AQCR, to date they have not actually classified any area as Class III. Therefore, any area that is not classified as a Class I area is, by default, automatically designated as a Class II AQCR (42 U.S.C. §7472).

In a 1979 USEPA memorandum, the Assistant Administrator for Air, Noise, and Radiation (USEPA, 1979) advised USEPA Regional Offices to provide notice to the Federal Land Manager (FLM) of any facility subject to the Prevention of Significant Deterioration (PSD) permit requirements and within 100 kilometers[113] of a Class I area (USEPA, 1992). "The [US] EPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (USEPA, 1979). 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 [US] EPA guidance for modeling air quality impacts under the PSD program has tended to focus more on the requirements for a Class II modeling analysis. Such guidance has provided that applicants need not model beyond the

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

point of significant impact or the source or 50 kilometers[114] (the normal useful range of USEPA-approved Gaussian plume models" (USEPA, 1992).

Iowa does not contain any federal Class I areas; all land within the state is classified as Class II (USEPA, 2012b). If an action is considered major source and consequently subject to PSD requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source (USEPA, 2016f). Additionally, no other adjacent states have Class I areas within 100 kilometers of the Iowa border. Therefore, notification to FLM will not be required for actions with Iowa or adjacent states.

6.1.13. Noise and Vibrations

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

6.1.13.1. Definition of the Resource

Noise is a form of sound caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012c). 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 and vibrations 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 and vibrations 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.

Ground-borne vibrations, which in many instances can be caused by tools or equipment that generate noise, can also result from roadway traffic, rail traffic, and industrial activities as well as from some construction-related activities such as blasting, pile-driving, vibratory compaction, demolition, and drilling. Unlike noise, most ground-borne vibrations are not typically experienced every day by most people because the existing environment does not include a significant number of perceptible ground-borne vibration events.

Fundamentals of Noise and Vibrations

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. The normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 2015i). The

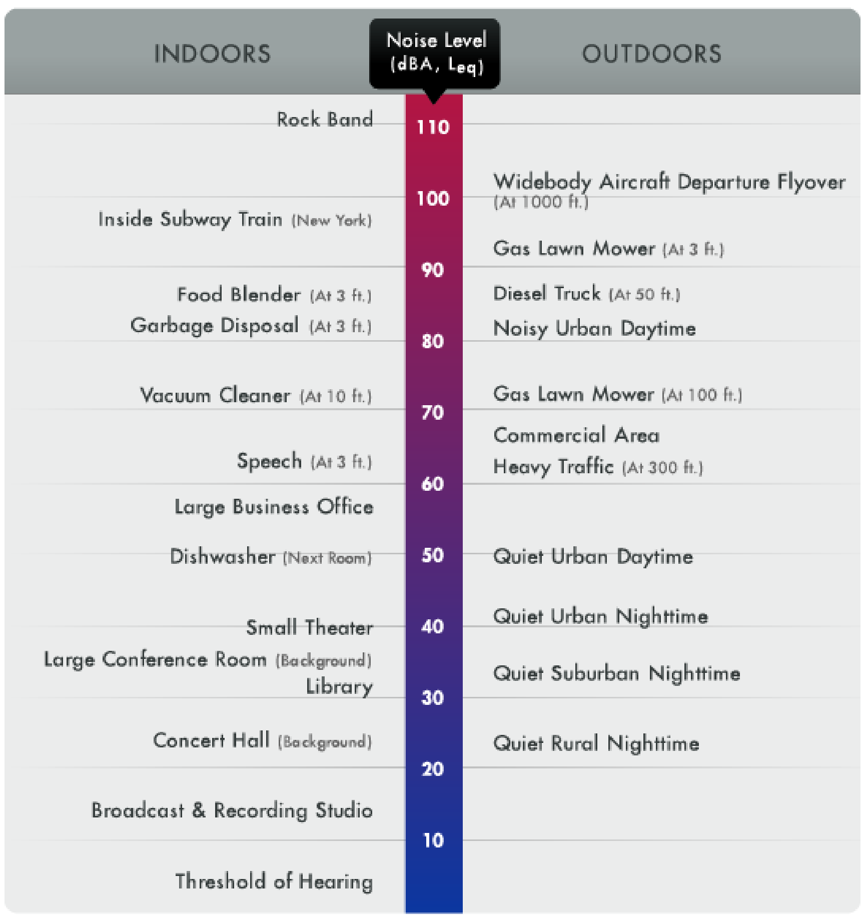
[114] The memorandum and associated guidance use kilometers. 50 kilometers is equal to about 31 miles.

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 (FTA, 2006):

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

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



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

Figure 6.1.13-1: Sound Levels of Typical Sounds

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

The changes in human response to changes in dB levels are categorized as follows (FTA, 2006):

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

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

Related to noise, vibration is a fluctuating motion described by displacement with respect to a reference point. Depending on the intensity, vibrations ma y create perceptible ground shaking and the displacement of nearby objects as well as rumbling sounds. Table 6.1.13-1 lists vibration source levels produced by typical construction machinery and activities at a distance of 25 feet in units of vibration decibels (VdB). The vibration thresholds for human perceptibility and potential building damage are 65 and 100 VdB, respectively (FTA, 2006).

Table 6.1.13-1: Vibration Source Levels for Select Construction Equipment (VdB)

Equipment[a]	VdB at 25 feet away
Pile Driver (impact type)	104-112
Pile Driver (sonic or vibratory type)	93-105
Vibratory Roller	94
Hoe Ram	87
Large Bulldozer	87
Caisson Drilling	87
Loaded Trucks	86
Jackhammer	79
Small Bulldozer	58

Source: FTA 2006

VdB = vibration decibels

[a] The types of equipment listed in this table are included for reference purposes only. It is possible that not all equipment types listed here would be used in the deployment and operation of the Proposed Action.

6.1.13.2. Specific Regulatory Considerations

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

Iowa has several statewide noise regulations, which are compiled under the IAC Code. They mainly apply to motor vehicle functions such as engine running and horns. Table 6.1.13-2 provides a brief summary of these regulations.

Table 6.1.13-2: Relevant Iowa Noise Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Motor Vehicles and Law of the Road (IAC 321.433)	Iowa State Patrol	Regulates the use of sirens, whistles, and bells on a vehicle.
Motor Vehicles and Law of the Road (IAC 321.436)	Iowa State Patrol	Requires the use of a muffler to prevent excessive noise on motor vehicles.

Source: (Iowa Department of Legislature, 2017h)

Many cities and towns may have additional, local noise ordinances to further manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Larger cities and towns, such as Des Moines, Davenport, and Cedar Rapids are likely to have different regulations than rural or suburban communities largely due to the population density and difference in ambient noise levels (FHWA, 2011).

6.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in Iowa varies widely based on the area and environment of the area. The population of Iowa can choose to live and interact in areas that are large cities, rural or suburban communities, small towns, and national and state parks. Figure 6.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Iowa may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Iowa. As such, this section describes the areas where the population of Iowa can potentially be exposed to higher than average noise levels.

- **Urban Environments:** Urban areas are likely to have higher noise levels on a daily basis due to highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (U.S. Department of the Interior, 2008). The urban areas that are likely to have the highest ambient noise levels in the state are Des Moines, Davenport, and Cedar Rapids.
- **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 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports is in proximity to urban communities resulting in noise exposures from aircraft operations (arrivals/departures) to surrounding areas at higher

levels and with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In Iowa, Des Moines International Airport (DSM) and the Eastern Iowa Airport (CID) have combined annual operations of more than 119,000 flights (FAA, 2015b). These operations result in increased ambient noise levels in the surrounding communities. See Section 6.1.7, Land Use, Recreation, and Airspace, and Table 6.1.7-9 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, 2015e). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living near those traffic corridors. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA, 2015e). See Section 6.1.1, Infrastructure, and Figure 6.1.1-1 for more information about the major highways in the state.
- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (FTA, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (FRA, 2015b). Iowa has two passenger rail corridors with commercial rail traffic. The Iowa section of the California Zephyr route stops in Burlington, Mount Pleasant, Ottumwa, Osceola, and Creston. The Iowa section of the Southwest Chief route stops in Fort Madison (IDOT, 2009). See Section 6.1.1, Infrastructure, and Figure 6.1.1-1 for more information about rail corridors in the state.
- **National and State Parks:** The majority of national and state parks are likely to have lower than average ambient noise levels given their sizes and locations. National and state parks, historic areas, and monuments are protected areas to preserve these areas in their natural environment. These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014g). Iowa has two NPS Units and seven National Natural Landmarks (NPS, 2015l). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 6.1.8, Visual Resources, and Figure 6.1.8-2 for more information about national and state parks for Iowa.

6.1.13.4. Sensitive Noise Receptors

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

6.1.14. Climate Change

6.1.14.1. Definition of the Resource

Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is defined as "…a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or human activity" (IPCC, 2007).

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 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 (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.[115]

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

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this PEIS (see Section 6.2, 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/drought, and 3) severe weather events.

6.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Section 1.8, Overview of Relevant Federal Laws and Executive Orders and Appendix C, Environmental Laws and Regulations. Iowa has not established goals or regulations to reduce GHG emissions to combat climate change. " (IDNR, 2016d).

[115] CO_2e refers to Carbon Dioxide Equivalent, "A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as million metric tons of carbon dioxide equivalents ($MMTCO_2e$). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. $MMTCO_2e$ = (million metric tons of a gas) * (GWP of the gas)" (USEPA, 2016j).

The Council on Environmental Quality (CEQ) published draft National Environmental Policy Act (NEPA) guidance on the consideration of the effects of climate change and greenhouse gas in February of 2010. Revised draft guidance was published in December 2014 and in August 2016 (after publication of the Draft PEIS) CEQ published its final guidance. This guidance is applicable to all federal agency actions and is meant to facilitate compliance within the legal requirements of NEPA. The CEQ guidance describes how federal agency actions should evaluate GHG and climate change effects in their NEPA reviews, using GHG emissions as a proxy for assessing a proposed action's potential effect on climate change. CEQ defines GHGs to include CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, which is in accordance with Section 19 (m) of *Executive Order 13693*. The final CEQ guidance suggests that agencies consider "(1) the potential effects of a proposed action on climate change as indicated by assessing GHG emissions (e.g. to include, where applicable, carbon sequestration); and (2) the effects of climate change on a proposed action and its environmental impacts." The final guidance recommends that agencies quantify an action's projected direct and indirect GHG emissions when data inputs are reasonably available to support calculations. The final guidance states that "agencies should be guided by the principle that the extent of the analysis should be commensurate with the quantity of the projected GHG emissions and take into account available data and GHG quantification tools that are suitable for and commensurate with the proposed agency action." In addition, CEQ recommends agencies evaluate project emissions and changes in carbon sequestration and storage, when appropriate, in assessing a proposed action's potential climate change impacts. The analysis should assess direct and indirect climate change effects of a proposed project including connected actions, the cumulative impacts of its proposed action, and reasonable alternatives. CEQ advises that climate change effects on the environmental consequences of a proposed action should be described based on available studies, observations, interpretive assessments, predictive modeling, scenarios, and other empirical evidence. The temporal bounds should be limited by the expected lifetime of the proposed project. Mitigation and adaptation measures should be considered in the analysis for effects that occur immediately and in the future.

6.1.14.3. Iowa Greenhouse Gas Emissions

Estimates of Iowa'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, 2015a). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015h). Individual states have developed their own GHG inventories, which are updated with different frequencies and trace GHG in a variety of ways.

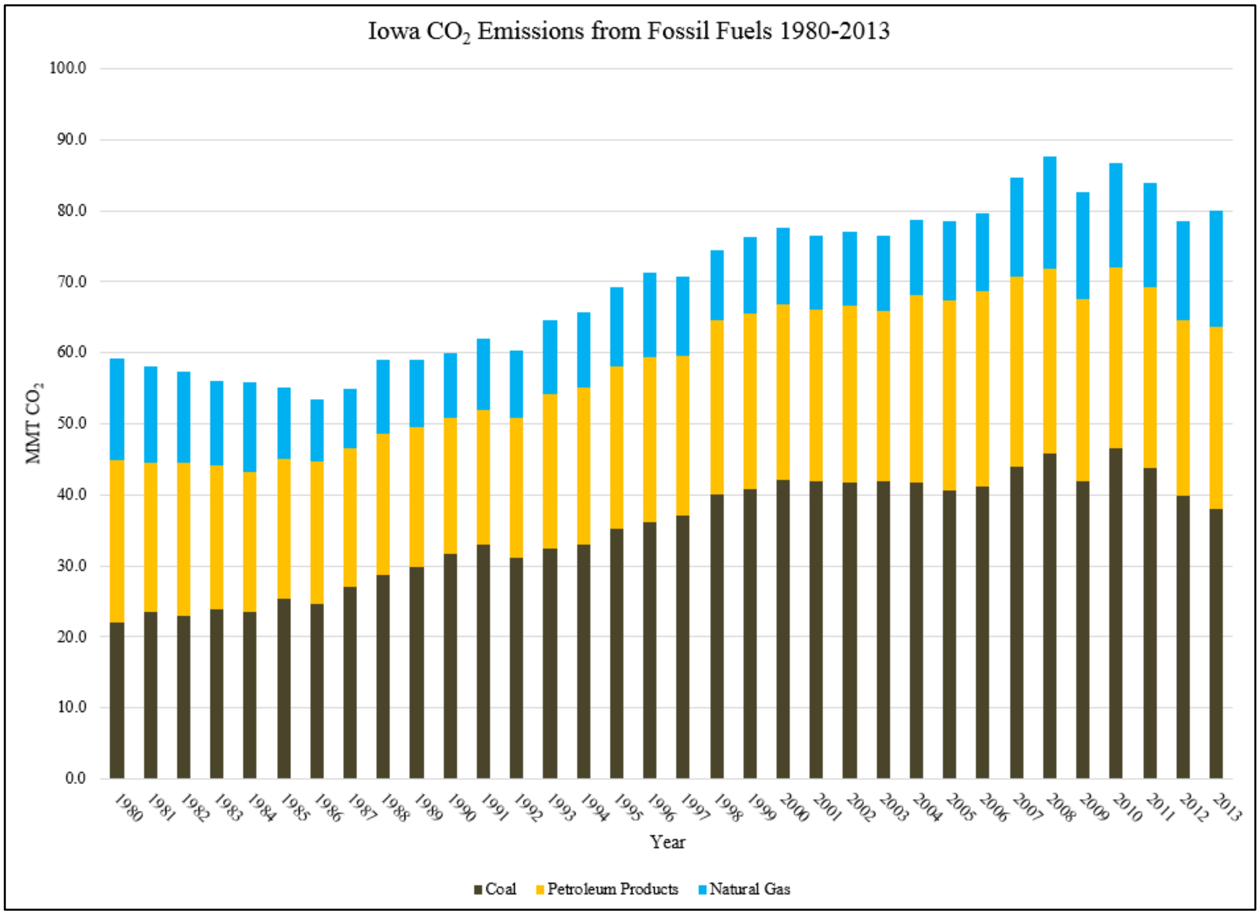
For the purposes of this PEIS, the EIA data on CO_2 emissions are used as the baseline metric to ensure consistency and comparability across the 50 states. However, if additional data sources on GHG emissions are available for a given state, including other GHGs such as CH_4, they are described and cited.

According to the EIA, Iowa emitted a total of 81.9 MMT of CO_2 in 2014. Almost half of CO2 emissions come from coal used by the electric power sector. The transportation sector is the second-largest emitter, mostly from petroleum products (Table 6.1.14-1) (EIA, 2015e) but followed closely by the industrial sector (Table 6.1.14-1) (EIA, 2015e). Annual emissions between 1980 and 2013 are presented in Figure 6.1.14-1 (EIA, 2015e). During the period between 1980 and 1986, Iowa's CO2 emissions decreased. Decreases were led by declines in emissions from natural gas even as coal emissions increased. From 1987 to 2008, CO2 emissions increased across all fuel types and across all sectors except the residential sector where emissions declined slightly. Reductions since 2008 have been led by reduced emissions from coal in the electric power sector with minor increases in natural gas emissions in the industrial sector. Emissions increased slightly in 2013 and 2014. Iowa ranked 25th in total CO2 emissions among the 50 states and the District of Columbia in 2013, and ranked 11th in per capita emissions (EIA, 2015b).

Table 6.1.14-1: Iowa CO_2 Emissions by Fuel Type and Source, 2014

Fuel Type (MMT)		Source (MMT)	
Coal	37.9	Residential	4.9
Petroleum Products	27.5	Commercial	4.6
Natural Gas	16.5	Industrial	19.0
		Transportation	20.9
		Electric Power	32.5
TOTAL	**81.9**	**TOTAL**	**81.9**

Source: (EIA, 2015e)



Source: (EIA, 2015e)

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

The majority of Iowa's GHG emissions are CO_2. These emissions are the result of fossil fuel combustion for producing energy, mostly petroleum products from electric power generating facilities and coal-fired power plants. Other major GHGs emitted in Iowa are CH_4, hydrofluorocarbons, NO_x, sulfur hexafluoride (SF_6) and perfluorocarbons (IDNR, 2015ag).

Iowa Code 455B.104 requires the IDNR to prepare a statewide inventory of Iowa's GHG emissions each year. The inventory was started in 2005. The most recent was published for 2014 emissions (IDNR, 2015ag). Iowa's total GHG emissions for 2014 were calculated to be 132.5 MMT CO_2e, dominated by agricultural emissions (36.0 MMT CO_2e); electric power (33.4 MMT CO_2e); and residential, commercial, and industrial fuel use (33.4 MMT CO_2e). For comparison, U.S. GHG greenhouse were 6,673 MMT CO_2e (14.7 trillion pounds) in 2013 (USEPA, 2015i). Agricultural emissions come from, "livestock and crop production such as enteric fermentation, manure management, agricultural soils, and burning of agricultural crop waste." (IDNR, 2015ag) In the last few years, these emissions have increase due to growth in beef cattle and swine populations and expanded crop production (IDNR, 2015ag).

GHG emissions from electric power generation have decreased over time, and were more than 20 percent lower than their 2010 due to improvements in power plant technology (IDNR, 2015ag). However, GHG emissions from the residential, commercial, and industrial fuel use category have increased by 39 percent since 2005. Emission fluctuations largely depend on the weather therefore, if there is a usually cold winter or hot summer, emissions will increase. Even with improvements in energy efficiency, light-duty vehicles reducing emissions in the transportation sector, and new laws and regulations for power plants and building energy codes, it is likely that GHG emissions in Iowa will decrease by 2030 (IDNR, 2015ag).

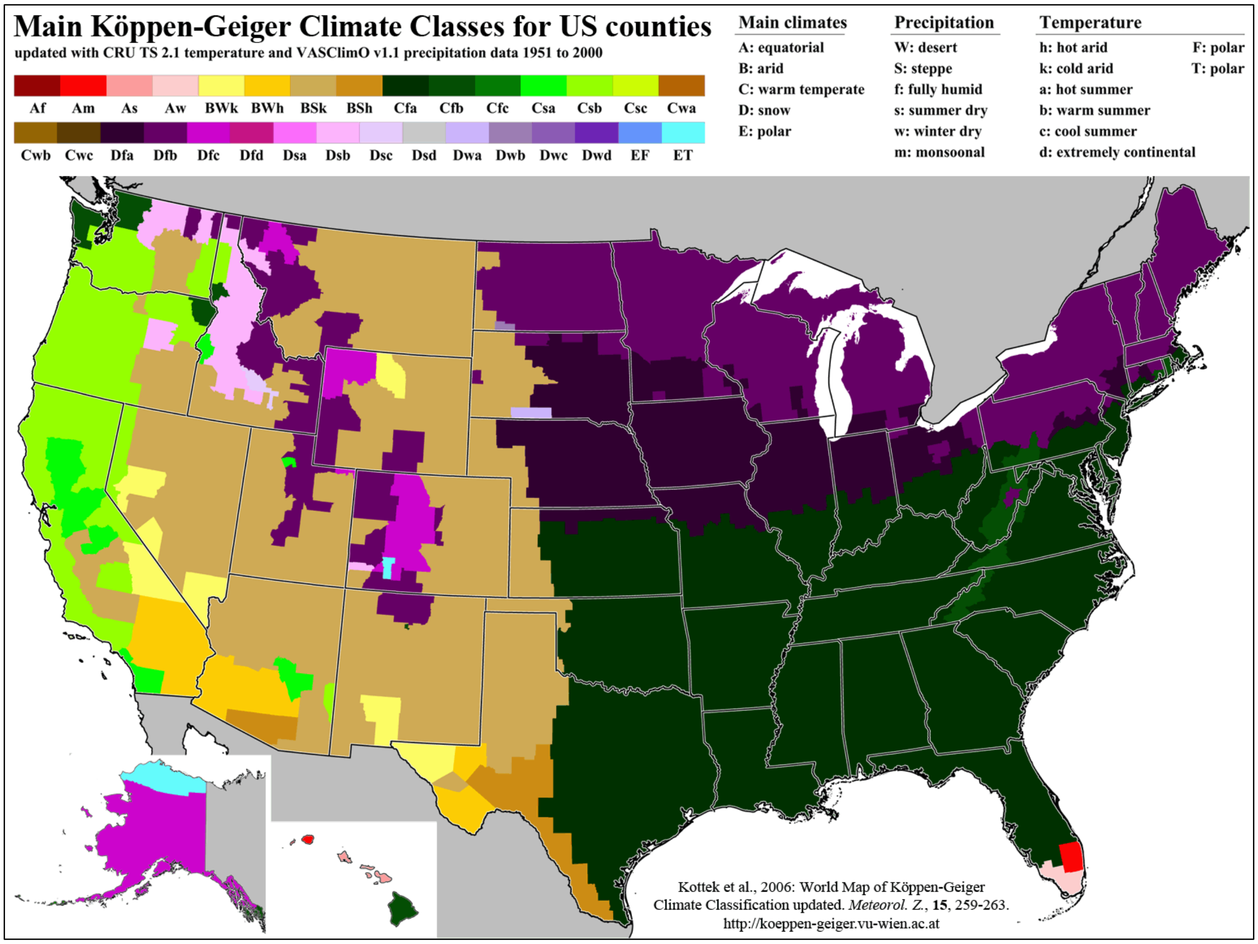
Iowa does not produce or refine oil, however, crude oil is imported from other states by two pipelines. Iowa has high liquefied petroleum gas (LPG) consumption from corn drying and home heating which results in related emissions being almost three times the U.S. average (EIA, 2015c). Iowa also has several pipelines that import natural gas into the state along with four natural gas storage fields. A majority of natural gas is consumed by the industrial sector while the remaining is used for home heating. Iowa relies heavily on coal for electricity generation even though coal is not produced in the state. Instead, coal is brought in from Wyoming by rail and sent to one of Iowa’s five coal-fired power plants. Iowa only has one nuclear power plant but relies heavily on wind-powered turbines for electricity (EIA, 2015c).

6.1.14.4. Environmental Setting: Existing Climate

The National Weather Service defines climate as the the “The composite or generally prevailing weather conditions of a region, throughout the year, averaged over a series of years” (NWS, 2009). The widely accepted division of the world into major climate categories is referred to as the Köppen-Geiger climate classification system. Climates within this system are classified based “upon general temperature profiles related to latitude” (NWS, 2017) The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly characteristics (NWS, 2017).

The entirety of Iowa falls into climate group D (see Figure 6.1.14-2). Climates classified as D are “moist continental mid-latitudinal climates,” with “warm to cool summers and cold winters” (NOAA, 2011a). In D climates, the “average temperature of the warmest month is greater than 50 degrees Fahrenheit (ºF), while the coldest month is less than negative 22°F” (NOAA, 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” (NOAA, 2011a) (NOAA, 2011b).

In addition, there are many thunderstorms during summer months. Iowa has one sub-climate categories, which is described in the following paragraphs.



Source: (Kottek, 2006)

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

Dfa – The Köppen-Geiger climate classification system classifies the entirety of Iowa as Dfa. Climates classified as Dfa are characterized by warm and humid temperatures, with hot summers and precipitation occurring regularly throughout the year. In this climate classification zone, the secondary classification indicates substantial precipitation during all seasons. In this climate classification zone, the tertiary classification indicates hot summer months, with warmer temperatures averaging above 71.6°F (NOAA, 2011a) (NOAA, 2011b).

This section discusses the current state of Iowa's climate with regard to air temperature, precipitation, and extreme weather events (e.g., flooding, thunderstorms, blizzards, and severe wind) in the state's climate regions, Dfa.

Air Temperature

Iowa's climate is "characterized by marked seasonal variations" (Hillaker, 2015). Average temperatures in the state range from 45°F in the north, to 52°F in the southeast. July is Iowa's warmest month, with average temperatures in the north ranging from morning lows of 61°F to afternoon highs of 82°F. In the south, July temperatures range from morning lows of 65°F to afternoon highs of 87°F. January is Iowa's coldest month, with average temperatures in the north ranging from morning lows of 4°F to afternoon highs of 22°F. In the south, January temperatures range from morning lows of 15°F to afternoon highs of 32°F. "The average number of days with maximum temperatures of 90°F or higher ranges from only 5 days in extreme northeast Iowa up to 36 days in the southwest corner of the state" (Hillaker, 2015). "The number of days with 0°F or lower minimum temperatures ranges from about 28 days along the Minnesota border to around 12 days along the Missouri border" (Hillaker, 2015).

Dfa – Des Moines, the capital of Iowa, is located within the climate classification zone Dfa. The average annual temperature in Des Moines is approximately 50.9°F; 25.3 °F during winter months; 74.2°F during summer months; 51.1°F during springs months; and 52.6°F during autumn months (NOAA, 2015b).

Precipitation

Precipitation in Iowa averages approximately 34 inches per year statewide, "ranging from 26 inches in the extreme northwest to as much as 38 inches in the southeast" (Hillaker, 2015). Approximately 75 percent of Iowa's annual rainfall occurs between April and September, with measurable precipitation occurring approximately 100 days out of the year. "The number of rainfalls exceeding one-half inch per day varies from about 15 days in the northwest to 25 days in the southeast" (Hillaker, 2015). The greatest 24-hour precipitation accumulation to occur was on June 14, 1998 with a record of 13.18 inches in the city of Atlantic (SCEC, 2015) (Hillaker, 2015).

Average snowfall across the state averages 32 inches, and varies from approximately 40 inches in the northeast to 20 inches in the southeast. The snow season in Iowa typically begins in late October and extends through mid-April. "The average number of days per season with snow cover one inch or deeper varies from about 40 days along the Missouri border to around 85 days along the Minnesota border" (Hillaker, 2015). December, January, and February typically receive the greatest amounts of snow, with an average of seven inches. The snowiest winter on record occurred between 1961 and 1962 with an average of 59 inches statewide. The greatest 24-hour snowfall accumulation total occurred on April 20, 1918 with a record of 24 inches (SCEC, 2015) (Hillaker, 2015).

Dfa – Des Moines, the capital of Iowa is located within the climate classification zone Dfa. The average annual precipitation accumulation in Des Moines is approximately 36.02 inches; 3.70 inches during winter months; 13.54 inches during summer months; 10.90 inches during spring months; and 7.88 inches during autumn months (NOAA, 2015b).

Severe Weather Events

Severe thunderstorms are common in Iowa, with approximately 45 to 65 occurring on average each year. Approximately 85 percent of thunderstorms occur between April and September, with a peak in June. "At times, these thunderstorms become severe, producing hail, high winds, torrential rain, and an occasional tornado" (Hillaker, 2015). Tornadoes in Iowa occur an average of 46 times a year, with May and June being the peak months for occurrence. Hail also occurs frequently in Iowa, with the majority of storms occurring in May. "Hail losses are greatest in the northwest, where hailstorms are typically more severe and also somewhat more frequent than in the southeast" (Hillaker, 2015).

Severe droughts can also occur in Iowa, "with the most severe in historical times occurring in the 1930s" (Hillaker, 2015). "Although droughts are not the spectacular weather events that floods, blizzards, or tornadoes can be, historically they produce more economic damage to the state than all other weather events combined" (Hillaker, 2015). Significant Iowa droughts have occurred in 1886, 1893 to 1894, 1901, 1954 to 1956, 1976 to 1977, and 1988 to 1989 (Hillaker, 2015).

Floods in Iowa are the most common during June, "which has the highest average rainfall of any month," approximately 4.65 inches. "Mid-March through early April is another favored time for flood occurrence when snowmelt, combined with rain and frozen soils, can produce significant flooding on major rivers" (Hillaker, 2015). Ice jams also contribute significantly to flooding. "Flash flooding from heavy thunderstorm rainfall is most frequent in the overnight hours from June through September" (Hillaker, 2015).

6.1.15. Human Health and Safety

6.1.15.1. Definition of the Resource

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

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) emissions , vehicle traffic, or the transportation of hazardous materials and wastes. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 6.1.1, Infrastructure. RF emissions are discussed in Section 2.4, RF Emissions.

There are unique infectious diseases throughout the continental US, such as Valley Fever[116]. Because of the great variety of diseases, as well as all of the variables associated with contracting them, this PEIS will not be evaluating infectious diseases. For information on infectious diseases, please visit the Centers for Disease Control and Prevention website at www.cdc.gov.

[116] Valley fever is caused by breathing in the spores of the fungus *Coccidiodes*, which lives in the soil of infected areas. Valley fever primarily occurs in the southwest and California, although it has recently been found in parts of Washington State. (Center for Disease Control and Prevention, 2017)

6.1.15.2. Specific Regulatory Considerations

Federal organizations, such as the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In Iowa, the Iowa Workforce Development, Division of Labor Services (IDLS), and the IDNR regulate this resource area. Federal OSH regulations apply to workers through either OSHA, or stricter state-specific plans that must be approved by OSHA. Iowa's Occupational Safety and Health (Iowa OSHA) State Plan is an OSHA-approved "State Plan," and includes state and local government employment regulations for railroad employee sanitation and shelter rules, community and public safety right-to-know hazardous chemical risks, and asbestos removal and encapsulation (OSHA, 2015a). OSHA enforces occupational safety and health regulations at the state level by Iowa OSHA compliance officers and at the federal level. The Iowa Department of Health and Human Services (IDHHS) regulates public health.

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

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

State Law and Regulation	Regulatory Agency	Applicability
State Abandoned Mined Land Fund (IAC 27-40.30)	IDALS	Establishes the Iowa Abandoned Mined Land Reclamation Program and outlines requirements for the reclamation, disposition, and operation of AMLs.
Aboveground Petroleum Storage Tanks (IAC 661-224)	Iowa Department of Public Safety	Establishes registration requirements for new and existing aboveground petroleum storage tanks, including inspections, and spill prevention, containment, and countermeasures.
Recording and Reporting Occupational Injuries and Illnesses (IAC 875-4)	Iowa Division of Labor Services (IDLS)	Requires reporting of occupational injuries and illnesses, including fatalities.
Right to Know Act (IAC 875-110)	IDLS	Outlines requirements for hazard communication, material safety data sheets (MSDS), labeling, and other right-to-know aspects for workplace safety.
Right to Know Act (IAC 875-130 and 875-140)	IDLS	Outlines requirements for hazard communication and right-to-know for the community and public safety/emergency response personnel.

Sources: (Iowa Department of Agriculture, 2017), (Iowa Department of Public Safety, 2006), (Iowa Department of Legislature, 2016a), (Iowa Department of Legislature, 2016b)

6.1.15.3. Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over water bodies, and on communication towers. Tasks may also be performed at dangerous heights or in confined spaces while operating heavy equipment, on energized equipment near underground and overhead utilities, and while using hazardous materials, such as flammable gases and liquids. Because telecommunication workers are often required to perform work outside, heat and cold exposure, precipitation, and lightning strikes also present hazard and risks depending on the task, occupational competency, and work-site monitoring. A summary description of the health and safety hazards present in the telecommunication occupational work environment is listed below.

Working from height, overhead work, and slips, trips, or falls – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights up to 2,000 feet above the ground's surface (OSHA, 2015b). In addition to tower climbing hazards, telecommunication workers have restricted workspace on rooftops or work from bucket trucks parked on uneven ground. Cumulatively, these conditions present fall and injury hazards to telecommunication workers, and the public who may be observing the work or transiting the area (International Finance Corporation, 2007).

Trenches and confined spaces – 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[117], are examples of when confined space work could occur. Installation of telecommunications activities involves laying conduit and limited trenching (generally 6-12 inches in width). Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics.

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. Telecommunications 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

[117] Manholes may be used for telecommunications activities, especially in cities and urban areas, depending on the location of other utilities. In cities, power, water, and telecommunication lines are often co-located; if access is through a manhole in the street, that access will be used.

and splicing activities, and can penetrate exposed skin (International Finance Corporation, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation presents risk of fire or explosion (Fiber Optic Association, 2010).

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

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

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

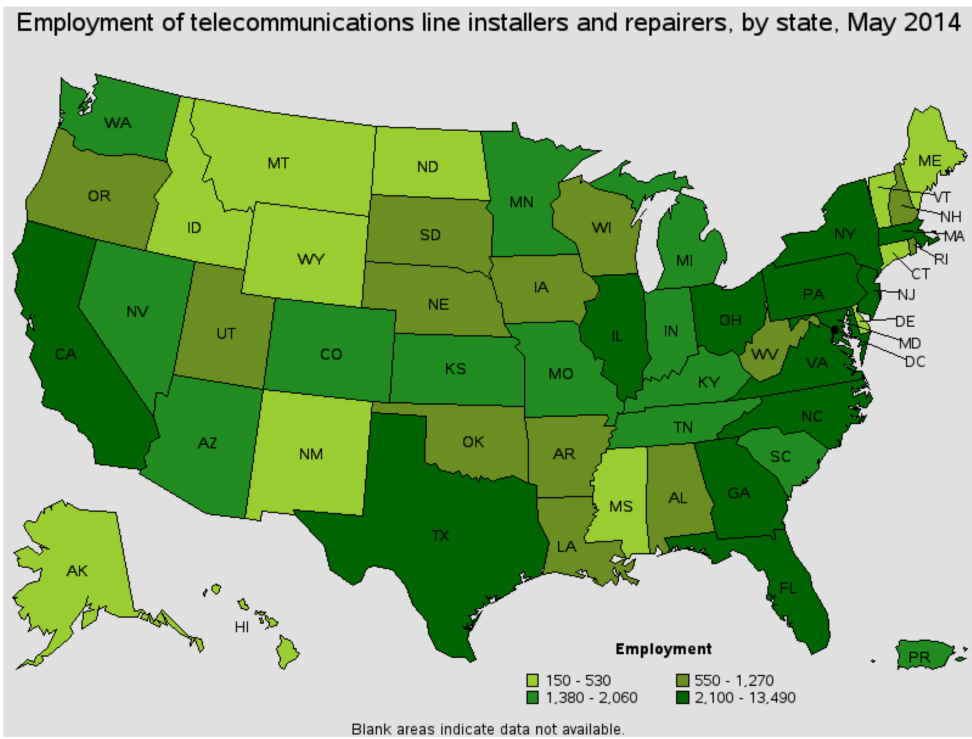
Outdoor elements – Weather conditions have the potential to quickly and drastically reduce safety, and increase hazards at telecommunication work sites. Excessive heat and cold conditions impact judgement, motor skills, hydration, and in extreme cases may lead to hyper- or hypothermia. Precipitation,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

Telecommunication Worker Occupational Health and Safety

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

As of May 2015, there were 1,970 telecommunication equipment installers and repairers, and 840 telecommunication line installers and repairers (Figure 6.1.15-1) working in Iowa (Bureau of Labor Statistics, 2015a). In 2013, the most recent year data are available, Iowa had 1.6 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).



Source: (Bureau of Labor Statistics, 2015g)

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

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; and 7 due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (Bureau of Labor Statistics, 2013c). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of occupational fatalities (4,585 total). Iowa had one occupational fatality in the telecommunications equipment installers and repairers occupation (SOC code 49-2022) in 2012. By comparison, within the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 74 fatalities in Iowa between 2003 and 2014, with the highest fatality years being 2004 and 2013, with 10 fatalities each (Bureau of Labor Statistics, 2015c).[118]

Public Health and Safety

The general public is unlikely to encounter occupational hazards at telecommunication sites due to limited access. IDPH collects environmental and public health data through the Iowa Public Health Tracking (IPHT) portal (Iowa Department of Public Health, 2015a). 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, between 1999 and 2013, there were 107 fatalities due to a fall from, out of, or through a building or structure; 43 fatalities due to being caught, crushed, jammed or pinched in or between objects; and 18 fatalities due to exposure to electric transmission lines (Centers for Disease Control and Prevention, 2015a). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

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

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

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[119] 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.

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

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

Iowa's Contaminated Sites Section administers the Superfund Program, and is managed under IDNR (IDNR, 2015ai). As of May 2016, Iowa had 50 RCRA Corrective Action sites,[120] 698 brownfield sites, and 12 proposed or final Superfund/NPL sites (USEPA, 2015j). Based on a May 2016 search of USEPA Cleanups in My Community (CIMC) database, there are no Superfund sites (USEPA, 2015k) and no RCRA Corrective Action sites (USEPA, 2015k) in Iowa where contamination has been detected at an unsafe level, or where a reasonable human exposure risk still exists. This means that at active Superfund or RCRA sites, where clean-up activities are underway, contamination exists but the contamination is under control and does not pose an immediate or emergency human health risk.

Brownfield sites in Iowa may enroll in a variety of programs managed by the IDNR, Office of Brownfield Reuse, including the Brownfield Redevelopment Program (IDNR, 2015an). One example of a brownfield site is the South Main Brownfield Project Area in Council Bluffs, IA. The site includes the historic 1.1-acre International Harvester warehouse building, formerly used for agricultural product sales and distribution. In 2006, site assessments discovered soils contaminated with polycyclic aromatic hydrocarbons (PAH) due to previous railroad activities. The site received more than \$7M in redevelopment funding and tax credits, transforming the warehouse into a mixed-use art and residential space (USEPA, 2012e).

In addition to contaminated properties, certain industrial facilities are permitted to release toxic chemicals into the air, water, or land. One such program is the Toxics Release Inventory (TRI), administered by the USEPA under the Emergency Planning and Community Right to Know Act (EPCRA) of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). As of October 2015, the USEPA reported that Iowa had 447 TRI reporting facilities (reporting 2013 data). 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, Iowa released 39.8M pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from petroleum and chemicals industries. This accounted for 0.97 percent of nationwide TRI releases, ranking Iowa 26 of 56 U.S. states and territories based on total releases per square mile (USEPA, 2015l).

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment. As of November 2, 2015, Iowa had 125 permitted

[120] Data gathered using USEPA's Cleanups in My Community (CIMC) search on November 4, 2015, for all sites in Iowa, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (USEPA, 2013b).

major discharge facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015m).

The National Institute of Health, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to "visually explore data from the USEPA's TRI and Superfund Program" (National Institute of Health, 2015). Figure 6.1.15-2 provides an overview of potentially hazardous sites in Iowa.

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over water bodies. Indoor air quOlcality may also be impacted from vapor intrusion infiltrating indoors from contaminated soil or groundwater that are present beneath a building's foundation. As of October 2015, there are 139 USEPA-regulated telecommunications sites in Iowa (USEPA, 2015n). These sites are regulated under one or more environmental programs including NPDES compliance, Superfund/NPL status, and TRI releases.

According to BLS data, Iowa had one occupational fatality each in 2012 and 2013 within the installation, maintenance, and repair occupations (SOC code 49-0000) from exposure to "harmful substances or environments," although these were not specific to telecommunications (Bureau of Labor Statistics, 2015c). By comparison, the BLS reported three fatalities in 2011 and three fatalities[121] in 2014 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 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 sources. If a contaminant enters a drinking water source, the surrounding community could inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors.

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

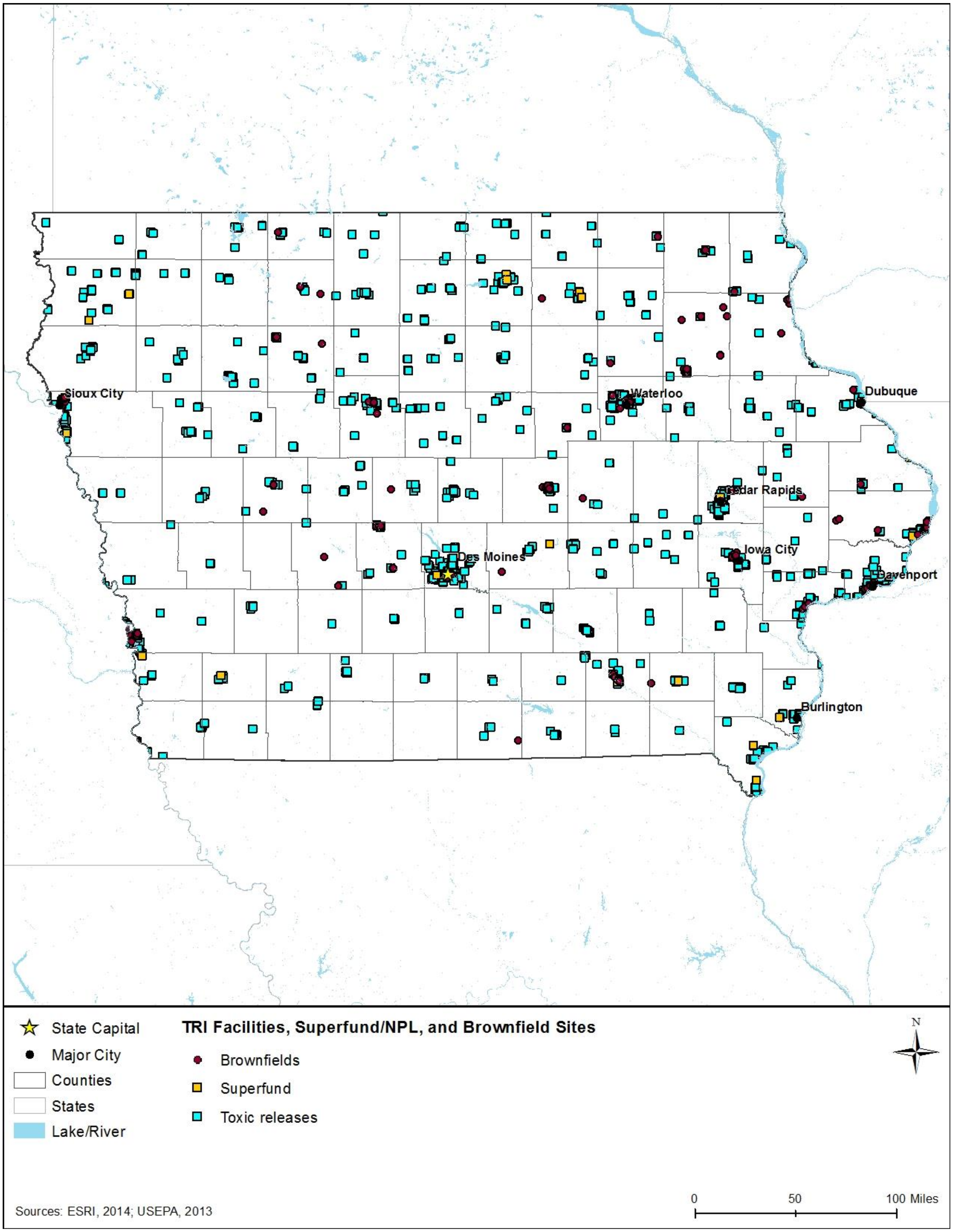
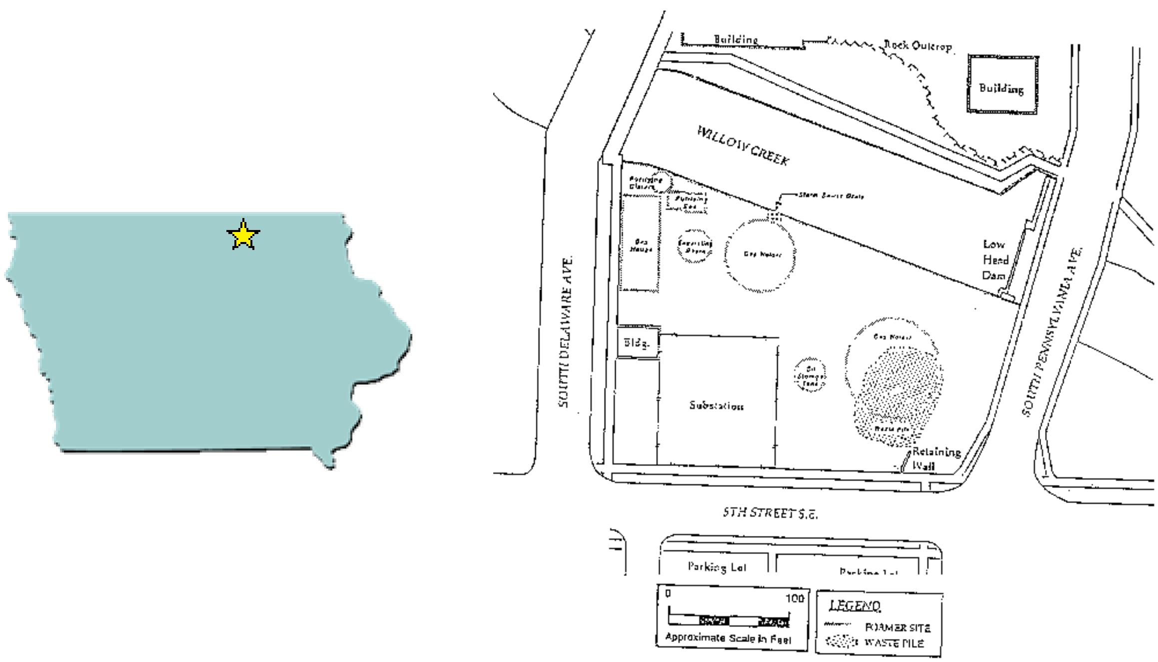


Figure 6.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Iowa (2013)

Spotlight on Iowa Superfund Sites: Mason City Coal Gasification Plant

The Mason City Coal Gasification Plant is a 2.3-acre site in downtown Mason City, IA (Cerro Gordo County) which produced gas for lighting and heating purposes from the early 1900s until 1951, when natural gas became available. In 1952, the plant was demolished and the site remained vacant excluding an electrical substation and storage building (Figure 6.1.15-3). In 1984, coal tar-contaminated soils and oily sludge were discovered during ground excavation for a municipal sewer construction project. Sewer construction was halted pending additional investigations (Iowa Department of Public Health, 2008).

In 1988, the potentially responsible parties removed three underground storage tanks and surrounding soils to reduce immediate threats to human health and the environment. The site was added to the NPL in 1994 after elevated levels of PAHs, volatile organic compounds (VOCs), inorganics, and metals were found in the soil and groundwater. In 1996, an additional 21,000 tons of contaminated soil were excavated and treated offsite, completing the removal action. Contamination still exists in the groundwater beneath the site, as well as in the sediments and fish in nearby Willow Creek, however, concentrations were determined to be below levels that would pose a health risk (USEPA, 2016d). In 2008, IDPH conducted a health assessment in coordination with the Agency for Toxic Substances and Disease Registry (ATSDR), and concluded that there were no public health hazards with implementation of access controls, such as perimeter fencing (Iowa Department of Public Health, 2008).



Source: (Iowa Department of Public Health, 2008), (Centers for Disease Control and Prevention, 2010)

Figure 6.1.15-3*:* Mason City Coal Gasification Site Map

The IDPH Bureau of Environmental Health Services partners with IDNR and USEPA as part of the Hazardous Waste Site Health Assessment Program to provide health assessments and consultations that identify and assess human exposure risks at contaminated sites. Public health assessments, consultations, and advisories for documented hazardous waste sites are publicly available through the IDPH Hazardous Waste Site Health Assessment Program website (Iowa Department of Public Health, 2015b). At the federal level, the Centers for Disease Control and Prevention, National Environmental Public Health Tracking Network, provides health, exposure, and hazard information, including known chemical contaminants, chronic diseases, and conditions based on geography. In 2009, the most recent data available, Iowa reported a rate of three injuries and fatalities due to reported acute toxic substance release incidents per 100,000 population (Centers for Disease Control and Prevention, 2015b).

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

Another health and safety hazard in Iowa includes surface and subterranean mines. In 2015, the Iowa mining industry ranked 30th for nonfuel minerals (primarily crushed stone, portland cement, sand and gravel, and lime), generating a value of $817M (USGS, 2016a). Health and safety hazards at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (Federal Mining Dialogue, 2015).

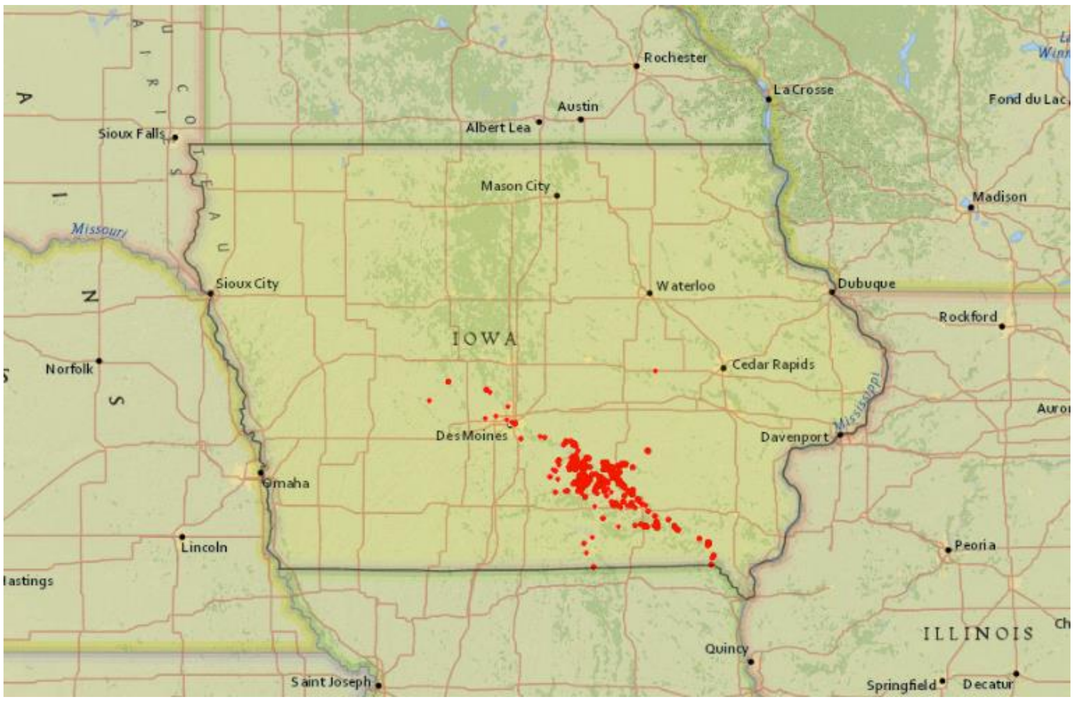
The IDALS, Mines and Minerals Bureau administers the Abandoned Mined Land Reclamation Program, and is responsible for managing AML health and safety hazards at more than 12,000 acres of pre-1977 coalmining sites (IDALS, 2015c). Figure 6.1.15-4 shows the distribution of High Priority (Priority 1, 2 and adjacent Priority 3) AMLs in Iowa, where Priority 1 and 2 sites pose a significant risk to human health and safety, and Priority 3 sites pose a risk to the environment. As of November 2015, Iowa had 268 Priority 1 and 2 AMLs, with 520 unfunded problem areas (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2015).

Telecommunication Worker Occupational Health and Safety

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

Public Health and Safety

Subterranean mines present additional health and safety risks to the 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 mine fires in particular, can result in evacuations of entire communities (U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, 2015).



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

Figure 6.1.15-4: High Priority Abandoned Mine Lands in Iowa (2015)

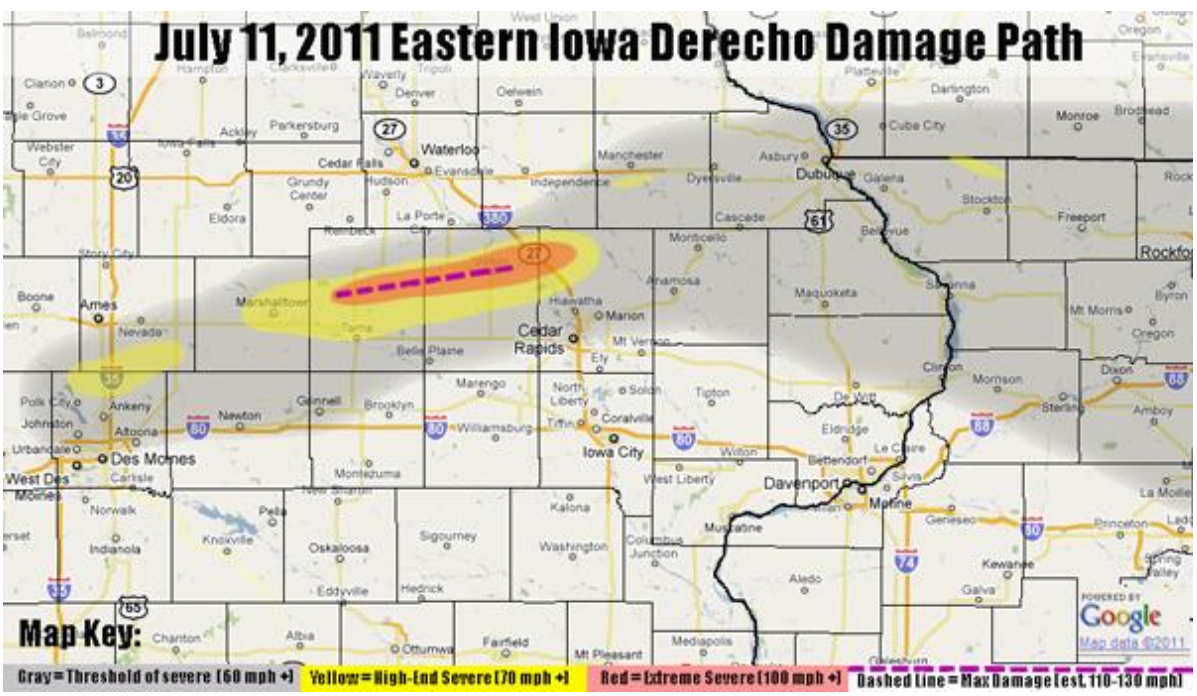
6.1.15.6. Environmental Setting: Natural and Manmade Disaster Sites

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).

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

Spotlight on Iowa Natural Disaster Sites: July 2011 Derecho

In July 2011, a powerful, long-lasting windstorm (known as a derecho) moved across Iowa, with wind speeds exceeding 100 miles per hour (Figure 6.1.15-5). Heavy winds and flash flooding caused severe damage in six Iowa counties (Benton, Clay, Dickinson, Marshall, Story, and Tama). Damaged critical facilities included two fire stations (Garrison, IA, and Clutier, IA), an emergency dispatch tower (Clutier, IA), emergency radio communications equipment and courthouse (Tama, IA), and a hospital (Vinton, IA). In Chelsea, IA, the 911 dispatch site lost power and exhausted battery backup systems, disrupting Voice over Internet Protocol (VoIP) and enhanced 911 services until power was temporarily restored using an emergency generator. Power outages were reported at 43,000 meters, including 68 pump stations, lift stations, and water towers in Benton, Marshall, Story, and Tama counties, as well as the water treatment plant in Tama, IA (Office of the Governor, 2011). Damage from the storms resulted in a Major Disaster Declaration (DR-4016) on August 24, 2011, with $6M in public assistance grants for response and recovery actions (FEMA, 2015b).



Source: (FEMA, 2015b)

Figure 6.1.15-5: Straight Line Wind Speed during July 11, 2011 Derecho in Iowa

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, IDLS 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 139 NRC-reported incidents for Iowa in 2015 with known causes, two were attributed to natural disaster (flood or other natural phenomenon), while 137 were attributed to manmade disasters (derailment, dumping, equipment failure, operator error, over pressuring, transport accident, or trespasser) or other indeterminate causes (USGS, 2015k). For example, during the July 2011 derecho, storm damage caused a natural gas leak, forcing the evacuation of 585 people in Garwin, Iowa (Office of the Governor, 2011). Such incidents present 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 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, Iowa had 6 weather-related fatalities (3 due to wind, 2 due to tornado, and 1 due to flooding) and 20 non-fatal injuries. By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year. (NOAA, 2015a).

6.2. ENVIRONMENTAL CONSEQUENCES

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

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

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

6.2.1. Infrastructure

6.2.1.1. Introduction

This section describes potential impacts to infrastructure in Iowa associated with construction, deployment, and operation of the Proposed Action and alternatives. Chapter 19, Best Management Practices (BMPs) and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to further avoid or minimize potential impacts.

6.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 6.2.1-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures incorporated, less than significant,* or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to infrastructure addressed in this section are presented as a range of possible impacts.

6.2.1.3. Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would primarily occur during the construction phases of deployment. Depending on the exact site locations and placement of new assets in the field, temporary impacts on traffic congestion, railway use, airport operations, or use of other transportation corridors could occur if site locations were near or adjacent to roadways and other transportation corridors, requiring temporary closures (lane closures on roadways, for example). Coordination would be necessary with the relevant transportation authority (i.e., departments of transportation, airport authorities, and railway companies) to ensure proper coordination during deployment. Based on the impact significance criteria presented in Table 6.2.1-1, such impacts would be *less than significant* at the programmatic level due to the temporary nature of the deployment activities, even if impacts would be realized at one or more isolated locations. Such impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

Capacity of Local Health, Public Safety, and Emergency Response Services

The capacity of local health, public safety, and emergency response services would experience *less than significant impacts* during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of local health, public safety, and emergency response services through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders to communicate during emergency response situations. Based on the impact significance criteria presented in Table 6.2.1-1, potential negative impacts would be *less than significant* at the programmatic level. Substantial beneficial impacts are likely to result from implementation.

Table 6.2.1-1: Impact Significance Rating Criteria for Infrastructure at the Programmatic Level

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

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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to utilities, including electric power transmission facilities and water and sewer facilities	Magnitude or Intensity	Substantial disruptions in the delivery of electric power or to physical infrastructure that results in disruptions, including frequent power outages or drops in voltage in the electrical power supply system ("brownouts"). Disruption in water delivery or sewer capacity, or damage to or interference with physical plant facilities that impact delivery of water or sewer systems.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Minor disruptions to the delivery of electric power, water, and sewer services, or minor modifications to physical infrastructure that result in minor disruptions to delivery of power, water, and sewer services.	There would be no perceptible impacts to delivery of other utilities and no service disruptions.
	Geographic Extent	Local/City, County/Region, or State/Territory.		Local/City, County/Region, or State/Territory.	Local/City, County/Region, or State/Territory.
	Duration or Frequency	Effects to other utilities would be seen throughout the entire construction phase.		Effects to other utilities would be of short duration (minutes to hours) and would occur sporadically during the entire construction phase.	NA

NA = Not Applicable

Modifies Existing Public Safety Response Telecommunication Practices, Physical Infrastructure, or Level of Service in a manner that directly affects Public Safety Communication Capabilities and Response Times

The Proposed Action and alternatives contemplated by FirstNet would not cause negative impacts to existing public safety response telecommunication practices, physical infrastructure, or level of service in a manner that directly affects public safety communication capabilities and response times. Based on the impact significance criteria presented in Table 6.2.1-1, any potential impacts would be *less than significant* during deployment. As described above, during deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to complement such practices and SOPs in a positive manner; therefore, only beneficial or complementary impacts would be anticipated. Public safety communication capabilities and response times would be expected to also experience beneficial impacts through enhanced communications abilities. It is possible that FirstNet would be upgrading physical telecommunications infrastructure, thus the infrastructure would also experience a positive and beneficial impact. Disposal or reuse of old public safety communications infrastructure would also likely need to be considered once the specifics are known. Any negative impacts would be expected to be *less than significant* given the short-term nature of the deployment activities.

Effects to Commercial Telecommunication Systems, Communications, or Level of Service

At the programmatic level, commercial telecommunication systems, communications, or level of service would experience *no impacts*, as such commercial assets would be using a different spectrum for communications. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, the spectrum use may be over-built or under-utilized.[122] Leases would then have *less than significant* positive impacts on commercial telecommunication systems, communications, or level of service, per the impact significance criteria presented in Table 6.2.1-1, due to the limited extent and temporary nature of the deployment.

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

The activities proposed by FirstNet would have *less than significant* impacts on utilities, including electric power transmission facilities, and water and sewer facilities, due to the limited extent and temporary nature of the deployment. Depending on the specific project contemplated,

[122] 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.

installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on a temporary or permanent basis. Also, depending on the specific project contemplated, the draw or use of power from the transmission facilities may need to be examined; however, it is not anticipated that such use of power would have negative impacts, due to the local nature of the proposed activities and the widespread availability and use of the power grid in the United States.

6.2.1.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to infrastructure and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result, at the programmatic level, in a range of *no impacts* to *less than significant impacts* depending on the deployment scenario or site-specific conditions. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, 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. At the programmatic level, 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* at the programmatic level on infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.
  - New Build – Submarine Fiber Optic Plant: At the programmatic level, the installation of cables in or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact, other than harbor operations. Impacts to infrastructure resources associated with the construction of landings and/or facilities on

shore or the banks of water bodies that accept the submarine cable are addressed below, and depend on the proximity of such infrastructure to the landing site.
    - 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 infrastructure at the programmatic level. The section below addresses potential impacts to infrastructure if construction of new boxes, huts, or other equipment is required near or adjacent to local infrastructure assets.
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: At the programmatic level, 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, at the programmatic level, this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to infrastructure as a result of implementation of the Preferred Alternative would encompass a range of impacts, at the programmatic level, 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),[123] huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase, however, it is anticipated that, at the programmatic level, this tie-in would cause *less than significant* impacts as the activity would be temporary and minor.

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

- New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new or replacement of existing telecommunications poles.
- Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact. 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 the submarine cable, depending on the exact site location and proximity to existing infrastructure.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment such as small boxes or huts, or access roads, could potentially impact infrastructure. Impacts could include disruption of service in transportation corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current utility services during installation or interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. In addition, installation activities would have beneficial impacts due to expansion of infrastructure at a local level. Such activities could enhance public safety infrastructure, and other telecommunications as the site could potentially be available for subsequent collocation.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would result in localized impacts to that tower and such as minor disruptions in services. As a result of collocation of equipment, the potential addition of power units, structural hardening, and physical security measures could potentially have beneficial impacts on existing infrastructure assets, depending on the site specific plans.
  - Deployable Technologies: Deployable technologies such as COWs, COLTs, and SOWs are comprised of cellular base stations, sometimes with expandable antenna masts, and generators that connect to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road ROWs and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation

congestion and delays. Implementation of deployable technologies could result in potential impacts to infrastructure resources in terms of infrastructure expansion, if deployment requires paving of previously unpaved surfaces or other new infrastructure build to accommodate the deployable technology. Also, beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Where deployable technologies would be implemented on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, or where aerial deployable technologies may be launched or recovered on existing paved surfaces, at the programmatic level, it is anticipated that there would be *no impacts* to infrastructure resources because there would be no disturbance of the natural or built environment.

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in to the electric grid. These impacts are expected to be *less than significant* as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the ongoing phase of deployment, and minor. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

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

Operation Impacts

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

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would also likely result in substantial improvements in level of service and communications capabilities. Operation of the NPSBN is intended to involve high-speed data capabilities, location information, images, and eventually streaming video, which would likely significantly improve communications and the ability of the public safety community to effectively engage and respond. The NPSBN is also intended to have a higher level of redundancy and resiliency than current commercial networks to support the public safety community effectively, even in events of extreme demand. This improvement in the level of resiliency and redundancy is intended to increase the reliability of systems, communications, and level of service, and also minimize disruptions and misinformation resulting from limited or disrupted service. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

6.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[124]

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, at the programmatic level, implementation of deployable technologies could result in *less than significant* impacts to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. Also, the site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try to avoid any negative impacts to such resources. Site-specific

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

analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. 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* at the programmatic level 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* at the programmatic level, to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access road or utility ROW, or if additional maintenance-related construction activities occur within public road and utility ROWs, *less than significant* impacts would likely still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables. Chapter 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*, at the programmatic level, to infrastructure from the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

6.2.2. Soils

6.2.2.1. Introduction

This section describes potential impacts to soil resources in Iowa 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 further avoid or minimize potential impacts.

6.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 6.2.2-1. As described in Section 6.2, Environmental Consequences, the categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures incorporated, less than significant,* or *no impact*.

Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to soil resources addressed in this section are presented as a range of possible impacts.

Table 6.2.2-1: Impact Significance Rating Criteria for Soils at the Programmatic Level

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

6.2.2.3. Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern of nearly every construction activity that involves ground disturbance. Construction erosion typically only occurs in a small area of land with the actual removal of vegetative cover from construction equipment or by wind and water erosion. Of concern in Iowa and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment could impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Areas exist in Iowa that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Aquepts, Aquults, Hemists, Orthents, Udalfs, Udepts, and Udults (see Section 6.1.2.4, Soil Suborders and Figure 6.1.2-2).

Based on the impact significance criteria presented in Table 6.2.2-1, building of some of FirstNet's network deployment sites could cause *potentially significant* erosion at locations with highly erodible soil and steep grades. However, for the majority of projects, impacts to soils would be expected to be *less than significant* at the programmatic level, given the short-term and temporary duration of the activities. Furthermore, deployment sites that are large-scale or adjacent to other construction sites (i.e., cumulatively large-scale sites) could result in long-term erosion that might not be reversed for several years.

To the extent practicable, FirstNet would attempt to minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 19).

Topsoil Mixing

The loss of topsoil (i.e., organic and mineral topsoil layers) by mixing is a potential impact at all ground disturbing construction sites, including actions requiring clearing, excavation, grading, trenching, backfilling, or site restoration/remediation work.

Based on impact significance criteria presented in Table 6.2.2-1, and due to the relatively small scale (less than 1 acre) of most FirstNet project sites, as well as the option to implement BMPs and mitigation measures (Chapter 19), minimal topsoil mixing is anticipated.

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, particularly if BMPs and mitigation measures are not implemented.

Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 6.1.2.3, Soil Suborders). The most compaction susceptible soils in Iowa are hydric soils with poor drainage conditions, which include Albolls, Aqualfs, Aquents, Aquepts, Aquerts, Aquolls, and Saprists. These suborders constitute approximately 24 percent of Iowa's land area,[125] and are found across the state (see Figure 6.1.2-2). The potential for compaction or rutting impact would be generally low at FirstNet network deployment sites where other soil types predominate.

Based on impact significance criteria presented in Table 6.2.2-1, the risk of soil compaction and rutting resulting from FirstNet deployment activities would be *less than significant* at the programmatic level due to the extent of susceptible soils in the state and the limited scale of deployment activities in any one location. Heavy equipment could cause perceptible compaction and rutting of susceptible soils, but could be minimized with implementation of BMPs and mitigation measures.

6.2.2.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to soil resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result, at the programmatic level, 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 at the Programmatic Level

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand-holes, pulling vaults, junction boxes, huts, and POP structures and would have *no impact* on 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 at the programmatic level. If physical access is required to light

[125] This percentage was calculated by dividing the acres of soils that fall within the suborders listed above by the total soil land cover for the state.

dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Deployment of temporary or portable equipment that use satellite technology, including COWs, COLTs, SOWs, satellite phones, and video cameras, would not impact soil resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact soil resources, it is anticipated that this activity would have no impact on soil resources at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

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

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

occur due to heavy equipment use during these activities depending on the duration of the construction activity.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of optical transmission equipment or centralized transmission equipment, including associated new utility poles, hand holes, pulling vault, junction box, hut, and POP structure installation, would require ground disturbance that could potentially impact soil resources. Potential impacts to soils resulting from soil erosion, topsoil mixing, soil compaction, and rutting are anticipated to be small-scale and short-term.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads could result in impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils. However, if additional power units, structural hardening, and physical security measures are needed, they may require ground disturbance, such as grading, or excavation activities, and 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 at the programmatic level because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be *less than significant*, as the activity would likely be short term, localized to the deployment locations, and those locations would return to normal conditions as soon as revegetation occurs, often by next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way for deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. At the programmatic level, 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* at the programmatic level due to the temporary nature and small scale of operations activities with the potential to create impacts. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

6.2.2.5. Alternatives Impact Assessment

The following section assesses potential impacts to soils associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to soil resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas. However, these potential impacts are expected to be *less than significant* at the programmatic level due to the small scale and short term nature of the deployment. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that, at the programmatic level, 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, at the programmatic level, the potential soil erosion would result in *less than significant* impacts as described above. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, at the programmatic level, there would be *no impacts* to soil resources as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.2, Soils.

6.2.3. Geology

6.2.3.1. Introduction

This section describes potential impacts to Iowa 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 further avoid or minimize potential impacts.

6.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 6.2.3-1. As described in Section 6.2, Environmental Consequences, the categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures 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 geological resources addressed in this section are presented as a range of possible impacts.

Table 6.2.3-1: Impact Significance Rating Criteria for Geology at the Programmatic Level

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

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

<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 BMP and Mitigation Measures Incorporated</th><th>Less than Significant</th><th>No Impact</th></tr>
<tr><td rowspan="3">Potential Mineral and Fossil Fuel Resource impacts</td><td>Magnitude or Intensity</td><td>Severe, widespread, observable impacts to mineral and/or fossil fuel resources.</td><td rowspan="3">Effect that is potentially significant, but with mitigation is less than significant.</td><td>Limited impacts to mineral and/or fossil resources.</td><td>No perceptible change in mineral and/or fossil fuel resources.</td></tr>
<tr><td>Geographic Extent</td><td>Regions of mineral or fossil fuel extraction areas are highly prevalent within the state/territory.</td><td>Mineral or fossil fuel extraction areas occur within the state/territory, but may be avoidable.</td><td>Mineral or fossil fuel extraction areas do not occur within the state/territory.</td></tr>
<tr><td>Duration or Frequency</td><td>Long-term or permanent degradation or depletion of mineral and fossil fuel resources.</td><td>Temporary degradation or depletion of mineral and fossil fuel resources.</td><td>NA</td></tr>
<tr><td rowspan="3">Potential Paleontological Resources impacts</td><td>Magnitude or Intensity</td><td>Severe, widespread, observable impacts to paleontological resources.</td><td rowspan="3">Effect that is potentially significant, but with mitigation is less than significant.</td><td>Limited impacts to paleontological and/or fossil resources.</td><td>No perceptible change in paleontological resources.</td></tr>
<tr><td>Geographic Extent</td><td>Areas with known paleontological resources are highly prevalent within the state/territory.</td><td>Areas with known paleontological resources occur within the state/territory, but may be avoidable.</td><td>Areas with known paleontological resources do not occur within the state/territory.</td></tr>
<tr><td>Duration or Frequency</td><td>NA</td><td>NA</td><td>NA</td></tr>
</table>

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMP and Mitigation Measures Incorporated	Less than Significant	No Impact
Surface Geology, Bedrock, Topography, Physiography, and Geomorphology	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Minor degradation or alteration of surface geology, bedrock, topography that do not result in measurable changes in physiographic characteristics or geomorphological processes.	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes.
	Geographic Extent	State/territory.		State/territory.	NA
	Duration or Frequency	Permanent or long-term changes to characteristics and processes.		Temporary degradation or alteration of resources that is limited to the construction and deployment phase.	NA

NA = Not Applicable

6.2.3.3. Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, landslides, and volcanic activity, and those that would be impacts from the project, such as land subsidence, mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Seismic Hazard

A concern related to deployment is placement of equipment in highly active seismic zones. Equipment that is exposed to earthquake activity is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss.

As discussed in Section 6.1.3.8, Iowa is not at risk to significant earthquake events. As shown in Figure 6.1.3-5, southeastern Iowa is at a slightly higher risk of earthquakes, including Davenport, though only 12 earthquakes originating in Iowa have been recorded since 1867" (Iowa Geological Survey, 2015). Based on the impact significance criteria presented in Table 6.2.3-1, seismic impacts from deployment or operation of the Proposed Action would have no impact, at the programmatic level, on seismic activity; however, seismic impacts to the Proposed Action could be *potentially significant* if FirstNet's deployment locations were within high-risk earthquake hazard zones. Given the potential for minor earthquakes in or near Iowa, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 19) could help avoid or minimize the potential impacts.

Volcanic Activity

Volcanoes were considered but not analyzed for Iowa, as they do not occur in Iowa; therefore, volcanoes do not present a hazard to the state.

Landslides

Similar to seismic hazards, another concern would be the placement of equipment in areas that are highly susceptible to landslides. Equipment that is exposed to landslides is subject to misalignment, alteration, or, in extreme cases, destruction; all of these activities could result in connectivity loss.

As discussed in Section 6.1.3.8, Iowa is moderately susceptible to landslides in northeastern and central portions of the state (Radbruch-Hall, et al., 1982), while areas in eastern Iowa along the Mississippi River (e.g., south of Dubuque), and in western Iowa along the Missouri River, experience moderate incidence of landslide events (Lohnes, Kjartanson, & Barnes, 2001). Areas in Iowa that are underlain by shale are especially vulnerable to landslide events (Lohnes, Kjartanson, & Barnes, 2001). Portions of eastern Iowa along the Mississippi River are particularly susceptible to landslides. Based on the impact significance criteria presented in Table 6.2.3-1, potential impacts to landslides from deployment or operation of the Proposed

Action would have *less than significant* impacts, as it is likely that FirstNet would attempt to avoid areas that are prone to landslides; however, landslides impacts to the Proposed Action could be potential significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that some of Iowa's major cities are in areas that experience landslides with moderate frequency, some amount of infrastructure could be subject to landslide hazards, in which case BMPs and mitigation measures (see Chapter 19) could help avoid or minimize the potential impacts.

Land Subsidence

As discussed in Section 6.1.3.8, portions of Iowa are vulnerable to land subsidence due to karst topography. Based on the impact significance criteria presented in Table 6.2.3-1, potential impacts to soil subsidence 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, 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 located in mining areas. Equipment that is exposed to land subsidence, such as sinkholes created by karst topography is subject to misalignment, alteration, or, in extreme cases, destruction. Sinkholes typically form in the eastern half of Iowa where overlying surface deposits are less than 50 feet thick. "There are three areas in Iowa where large numbers of sinkholes exist: (1) within the outcrop belt of the Ordovician Galena Group carbonates in Allamakee, Clayton, and Winneshiek counties; (2) in Devonian carbonates in Bremer, Butler, Chickasaw, and particularly Floyd and Mitchell counties; and (3) along the erosional edge of Silurian carbonates in Dubuque and Clayton counties" (Iowa Geological Survey, 2015). Figure 6.1.3-6 shows the location of areas in Iowa that are susceptible to land subsidence due to karst topography. Significant long-term land subsidence could occur due to factors such as aquifer compaction and inundation of equipment. All of these activities could result in connectivity loss. A second cause of land subsidence in Iowa is mine collapse, "by which the land surface sinks from collapse of the mine roof or failure of the support pillars." Up to 6,000 coal mines, affecting up to 80,000 acres of land, may exist in Iowa. Subsidence hazards related to these mines are expected to continue into the future (Iowa Geological Survey, 2015). Figure 6.1.3-7 displays the location of coal mines throughout the state. Impacts are expected to be *less than significant* as FirstNet would generally seek to avoid locations that have experienced mine collapse or karst-induced subsidence.

To the extent practicable, FirstNet would avoid deployment in known areas of karst topography or in known areas that may contain coal mines. However, where infrastructure is subject to landslide hazards, BMPs and mitigation measures, as discussed in Chapter 19, could help avoid or minimize the potential impacts.

Potential Mineral and Fossil Fuel Resource Impacts

Equipment deployment near mineral and fossil fuel resources are not likely to affect these resources. Rather the new construction is only likely to limit access to extraction of these resources. Based on the impact significance criteria presented in Table 6.2.3-1, impacts to mineral and fossil fuel resources are expected to be *less than significant* as the Proposed Action could only be *potentially significant* if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. To the extent practicable, FirstNet would avoid construction in areas where these resources exist. Chapter 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 Paleontological Resource Impacts

Equipment installation and construction activities that require ground disturbance could damage existing paleontological resources, which are both fragile and irreplaceable. Based on the impact significance criteria presented in Table 6.2.3-1, impacts to paleontological resources could be *potentially significant* if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. As discussed in Section 6.1.3.8, fossils are abundant in parts of Iowa. At the programmatic level, it is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Implementation of BMPs and mitigation measures (see Chapter 19) could further help avoid or minimize the potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that degrade or alter surface geology, bedrock, or topography could cause measurable changes in physiographic characteristics of an area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in , impacts would be *less than significant* at the programmatic level as FirstNet's deployment is unlikely to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and *less than significant* at the programmatic level, as proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures (see Chapter 19) could be implemented to help avoid or minimize the potential impacts.

6.2.3.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

Implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities, at the programmatic level, 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, at the programmatic level, 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 at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, 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 at the programmatic level since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* on geologic resources at the programmatic level 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, at the programmatic level, this activity would have no impact on geologic resources.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral and fuel resources and paleontological resources. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
    - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
    - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, minor earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water is not expected to impact geologic resources including marine paleontological resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
    - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.
- Wireless Projects
    - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or disturbance of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if additional power units, structural hardening, and physical security measures required ground

disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, 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 at the programmatic level because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact on the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geologic resources associated with deployment could include minimal removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet projects are likely to be small scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small scale. Therefore, these potential impacts are expected to be *less than significant* at the programmatic level. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. At the programmatic level, it is anticipated that there would be *no impacts* to geology associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections.

The operation of the Preferred Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts, at the programmatic level, would be anticipated to be *less than significant*, as it is anticipated that deployment locations would avoid, as practicable and feasible, locations that are more likely to be affected by potential seismic activity, landslides, or land subsidence. Chapter 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.

6.2.3.5. Alternatives Impact Assessment

The following section assesses potential impacts to geology associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

Implementation of deployable technologies on existing paved surfaces would not result in impacts to geologic resources (or from geologic hazards) as there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be *less than significant* at the programmatic level due to the minor amount of paving or new infrastructure needed to accommodate the deployables. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that, at the programmatic level,there would be *no impacts* to geologic resources (or from geologic hazards) associated with routine inspections of the Preferred Alternative.

The operation of the Deployable Technologies Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be *less than significant* as the deployment would be temporary and likely would attempt to avoid locations that were subject to increased seismic activity, landslides, and land subsidence. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, at the programmatic level, there would be *no impacts* to geologic resources (or from geologic hazards) as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.3, Geology.

6.2.4. Water Resources

6.2.4.1. Introduction

This section describes potential impacts to water resources in Iowa 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 further avoid or minimize potential impacts.

6.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 6.2.4-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures incorporated, less than significant,* or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to water resources addressed in this section are presented as a range of possible impacts.

Table 6.2.4-1: Impact Significance Rating Criteria for Water Resources at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, SDWA.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		The impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Floodplain degradation[a]	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		The impact is temporary, lasting no more than one season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		The impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is *potentially significant*, but with mitigation is *less than significant*.	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts.	Activities do not impact groundwater or aquifers.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact is ongoing and permanent.		Potential impact is temporary, not lasting more than six months.	NA

[a] Since public safety infrastructure is considered a critical facility, project activities should avoid the 500-year floodplain wherever practicable, per the Executive Orders on Floodplain Management (EO 11988 and EO 13690).
NA = Not Applicable

6.2.4.3. Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the CWA requires states to assess and report on the quality of waters in their state. Section 303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

More than half of Iowa's assessed rivers and streams, as well as lakes, reservoirs, and ponds, are impaired. The largest cause of water quality issues in Iowa is nonpoint source pollution,[126] particularly sediment and nutrient runoff from agricultural lands, urban areas, open spaces, roads, parking lots, and construction activities. Sediment runoff comes mostly from agricultural activities such as livestock in feedlots, woodlands, and pastures, as well as tilling of croplands. Sediment could also come from erosion of streambanks and lakeshores, as well as during construction activities. Nutrients, especially phosphorus and nitrogen, are common pollutants, and come from use of fertilizers on both agricultural and residential lands and from organic sources, including manure and human waste (IDNR, 2015al). Generally, Iowa's groundwater is suitable for drinking and daily water needs, with some limitations from naturally occurring dissolved solids, hardness, and radioactivity in some areas (IDNR, 2003).

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 1 acre of soil, a state or USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a stormwater pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

[126] Nonpoint source pollution: a source of pollution that does not have an identifiable, specific physical location or a defined discharge point. Non-point source pollution includes nutrients that run off croplands, lawns, parking lots, streets and other land uses. It also includes nutrients that enter waterways via air pollution groundwater, or septic systems (USEPA, 2015b).

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs could reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA, and Safe Drinking Water Act), and local regulations, cause a threat to the human environment, biodiversity, or ecological integrity through water degradation, or cause a sediment water quality violation from local construction, or otherwise substantially degrade water quality.

Therefore, based on the impact significance criteria presented in Table 6.2.4-1, water quality impacts would likely be *less than significant*, and could be further reduced if BMPs and mitigation measures were to be incorporated where practicable and feasible.

During implementation of the Proposed Action and Alternatives, there is the potential to encounter shallow groundwater due to clearing and grading activities, shallow excavation, or relocation of utility lines. This is unlikely, as trenching is not expected to exceed a 48-inch depth. However, groundwater contamination may exist in areas directly within or near the project area. If trenching[127] 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 Iowa dewatering requirements. Any groundwater extracted during dewatering activities or as required by a dewatering permit would be treated prior to discharge or disposed of at a wastewater treatment facility.

Due to average thickness of most Iowa aquifers, there is little potential for groundwater contamination within a watershed or multiple watersheds. Thus, it is unlikely that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer, and based on the impact significance criteria presented in Table 6.2.4-1, at the programmatic level, there would likely be *less than significant* impacts on groundwater quality within most of the state. In areas where groundwater is close to the surface, such as in northern and central Iowa, then site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Furthermore, BMPs, and mitigation measures could be implemented to further reduce potential impacts.

[127] 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).

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on humans, buildings, roads and other infrastructure. The 500-year floodplain is the area of minimal flood hazard, where there is a 0.2-percent-annual-chance flood. Some projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 6.2.4-1, floodplain degradation impacts would be potentially *less than significant* since the majority of FirstNet's likely deployment activities, on the watershed or subwatershed level, would occur inside the 500-year floodplain, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede or redirect flood flows or impact floodplain hydrology, and would not 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,[128] 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 that is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that include pervious surfaces such as gravel parking lots.
- Land uses that do not change the flow of water or drainage patterns.
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures would reduce the risk of additional impacts to floodplain degradation (see Chapter 19).

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. For example, 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. Another example of land disturbance changing existing drainage patterns could from channeling (straightening or restructuring natural watercourses); creation of impoundments (detention basins, retention basins, and dams); stormwater increases; or altered flow patterns.

According to the significance criteria in Table 6.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or subwatershed level would be considered *less than significant* at the programmatic level.

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[128] A water year is defined as "the 12-month period October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months" (USGS, 2016c).

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited stormwater runoff.
- Activities designed so that stormwater is contained on site and does not flow to or impact surface waterbodies offsite on other properties.
- Activities designed so that the amount of stormwater generated before construction is the same as afterwards.
- Activities designed using low impact development techniques for stormwater.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term; impacts to drainage patterns would be *less than significant* at the programmatic level. BMPs and mitigation measures could be implemented to further reduce any *potentially significant* impacts.

Flow Alteration

Flow alteration refers to the modification of flow characteristics, relative to natural conditions. Human activities may change the amount of water reaching a stream, divert flow through artificial channels, or alter the shape and location of streams. Surface water and groundwater withdrawals could alter flow by reducing water volumes in streams. Withdrawals may return to the surface/groundwater system at a point further downstream, be removed from the watershed through transpiration by crops, lawns or pastures, or be transferred to another watershed altogether (e.g., water transferred to a different watershed for drinking supply). Altered flow could increase flooding and introduce more erosion and potential for pollution. Alternatively, if water is diverted from its normal flow, the opposite may occur; wetlands and streams may not receive as much water as necessary to maintain the ecology and previous functions.

Activities that do not impact discharge or stage of waterbody (stream height) are not anticipated to have an impact on flow, according to Table 6.2.4-1. Projects that include minor consumptive use of surface water with *less than significant* impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) are likely to have *less than significant* impacts on flow alteration, on a watershed or subwatershed level. Examples of projects likely to have *less than significant* impacts include:

- Construction of any structure in a 100-year or 500-year floodplain that is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns off site or into surface water bodies that have not received that volume of stormwater before.
- Minor clearing or grading activities.

Since the Proposed Action would not likely alter flow characteristics or change the hydrologic regime, *less than significant* impacts to flow alteration are anticipated. BMPs and mitigation measures could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 6.1.4.7, approximately 80 percent of Iowa's population draws its drinking water from Iowa's groundwater resources. Generally, the water quality of Iowa's groundwater is suitable for drinking and daily water needs, with some limitations from naturally occurring dissolved solids, hardness, and radioactivity in some areas. Groundwater is an important natural resource used by industrial, commercial, agricultural, and residential uses for manufacturing, irrigation, and drinking water purposes. Once a groundwater supply is exhausted or contaminated, it is very expensive, and sometimes impossible, to replace. Water supply demand from the deployment activities is unlikely to exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer (Moody, Carr, Chase, & Paulson, 1986).

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. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented to minimize 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.

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, as practicable and feasible, be considered to avoid areas that would extract groundwater from potable groundwater sources in the area.

6.2.4.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result, at the programmatic level, 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 at the Programmatic Level

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. At the programmatic level, 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* on water resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: At the programmatic level, 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 at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

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 near bodies of water could 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 environments.
    - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
    - Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
    - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to water resources at the programmatic level.
- Wireless Projects
    - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
    - 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 the delivery of additional power units, structural hardening, and physical security measures required ground disturbance, impacts to water resources could occur, including increased

suspended solids leading to impaired water quality and impacts to groundwater from excavation.

- Deployable Technologies: Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Where deployable technologies would be implemented on existing paved surfaces, or where aerial and vehicular deployable technologies may be used on existing paved surfaces, it is anticipated that there would be *no impacts* to water resources because there would be no ground disturbance at the programmatic level.
- 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* at the programmatic level. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure would likely be *less than significant* at the programmatic level due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is 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 further avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have *no impacts* at the programmatic level as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along existing roads and utility ROWs. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. At the programmatic level, there would be *no impacts* to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation. 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.

6.2.4.5. Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to water resources if the deployment occurred on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving, however, these activities would be isolated and short term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites and from fuels leaking into surface or groundwater. However, spills from vehicles or machinery used during deployment tend to be associated with re-fueling operations, and as such, would likely be a few gallons or less in volume and would likely be easily contained or cleaned up. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource's current use (water considered exceptional value for recreation, or provides critical habitat for a species).

At the programmatic level, 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, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies, however, due to the limited and temporary nature of the deployable activities, it is anticipated that these potential impacts would be *less than significant* at the programmatic level. Site maintenance, including mowing or herbicides, may result in *less than significant* effects to water quality, due to the small scale of expected FirstNet activities in any particular location. In addition, the presence of new access roads could increase the overall amount of impervious surface in the areas, and increase runoff effects on water resources, as explained above. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to water resources at the programmatic level as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.4, Water Resources.

6.2.5. Wetlands

6.2.5.1. Introduction

This section describes potential impacts to wetlands in Iowa 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 further avoid or minimize potential impacts.

6.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 6.2.5-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures 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 6.2.5-1: Impact Significance Rating Criteria for Wetlands at the Programmatic Level

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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Indirect effects:[b] change in function(s)[c] change in wetland type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.).	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No changes in wetland function or type.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Long-term or permanent.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA

[a] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories (USACE 2014). Category 1 are the highest quality, highest functioning wetlands

[b] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type

[b] 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.

6.2.5.3. Description of Environmental Concerns

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

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

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, vibrations, light, and other human disturbance. To the extent practicable or feasible, FirstNet and/or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be *less than significant* given the amount of land disturbance associated with likely proposed individual sites (generally less than an acre) and the limited extent of the deployment activities. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (see Chapter 19).

There are more than 723,000 acres of wetlands throughout Iowa. Palustrine (freshwater) wetlands are the main type of wetlands (91 percent) in the state. They are found on river and lake floodplains across the state, as shown in Figure 6.1.5-1. Riverine and lacustrine wetlands comprise approximately six and three percent, respectively, of the other wetlands in the state (USFWS, 2014a).

Based on the impact significance criteria presented in Table 6.2.5-1, the deployment activities would most likely have *less than significant* direct impacts on wetlands at the programmatic level. Additionally, the deployment activities would be unlikely to violate applicable federal, state, and local regulations.

Potential Other Direct Effects

Other direct impacts consist of altering the chemical, physical, or biological components of a wetland to the extent that changes to the wetland functions occur. However, other direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through mechanical or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as stormwater discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 6.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) could cause *potentially significant* impacts. Other direct effects to high- and low-quality wetlands would be *less than significant* given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. To minimize any potential impacts to wetlands, BMPs, and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 19, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts

Examples of activities that could have other direct effects to wetlands in Iowa 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:[129] Change in Function(s)[130] 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. At the programmatic lelve, indirect effects to both high- and low-quality wetlands would be *less than significant* given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (See Chapter 19). Examples of functions related to wetlands in Iowa that could potentially be impacted from construction-related deployment activities include:

- *Flood Attenuation:* Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they can lower flood peaks by providing detention of storm flows. Correspondingly, disturbance of the wetlands (e.g., dredging or filling) could proportionately reduce water storage function.
- *Bank Stabilization:* By reducing the velocity and volume of flow, wetlands provide erosion control, floodwater retention, and reduce stream sedimentation.
- *Water Quality:* Water quality impacts on wetland soils could eventually threaten a wetland's existence. Where sediment inputs exceed rates of sediment export and soil consolidation, a wetland would gradually become filled.
- *Nutrient Processing:* Wetland forests retain ammonia during seasonal flooding. Wetlands absorb metals in the soils and by plant uptake via the roots. They also allow metabolism of oxygen-demanding materials and reduce fecal coliform populations. These pollutants are often then buried by newer plant material, isolating them in the sediments.
- *Wildlife Habitat:* Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding could harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes could have impacts on the preferred food supply and animal cover.
- *Recreational Value:* Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- *Groundwater Recharge:* Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

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[129] 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.

[130] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

According to the significance criteria defined in Table 6.2.5-1, impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity), would be considered potentially *less than significant* at the programmatic level. Since there are no regulated high quality wetlands in Iowa, deployment activities could have *less than significant* indirect impacts on wetlands 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 further avoid or minimize potential impacts.

In areas of the state with high quality wetlands, there could be *potentially significant* impacts at the project level that would be analyzed on a case-by-case basis. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. If avoidance were not possible, BMPs and mitigation measures would help to mitigate impacts.

6.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations could be required to determine the exact location of all wetlands, 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, at the programmatic level, 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 at the Programmatic Level

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, at the programmatic level, 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. At the programmatic level, 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* on wetlands at the programmatic level because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: At the programmatic level, 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 would have no impact on 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 at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and/or indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would potentially impact wetlands 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 (See Chapter 19) could reduce impact intensity.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drones, balloons, or blimps piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be *less than significant* at the programmatic level due to the small amount of land disturbance (generally less than one acre) and the short timeframe of deployment activities. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Depending on the proximity to wetlands, it is anticipated that there could be ongoing other potential direct impacts to wetlands if heavy equipment is used for routine operations and maintenance or if application of herbicides occurs to control vegetation along ROWs and near structures. 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* at the programmatic level due to the limited nature of deployment activities. It is also anticipated that routine maintenance activities would be conducted on existing roads and utility ROW. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

6.2.5.5. Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and/or indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be *less than significant* at the programmatic level due to the small scale and temporary duration of expected FirstNet deployment activities in any one location. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance could result in impacts similar to the abovementioned deployment impacts. The wetlands impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the wetland's quality and function. It is anticipated that impacts would be *less than significant* at the programmatic level due to the small-scale nature of operation activities.

At the programmatic level, it is anticipated that there would be *less than significant* impacts to wetlands associated with routine inspections of the Deployable Technologies Alternative as it is likely existing roads and utility ROW would be utilized for maintenance and inspection activities. 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. 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 further avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to wetlands, at the programmatic level, from the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.5, Wetlands.

6.2.6. Biological Resources

6.2.6.1. Introduction

This Section describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Iowa 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 further avoid or minimize potential impacts.

6.2.6.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on terrestrial vegetation, wildlife, fisheries, and aquatic habitats were evaluated using the significance criteria presented in Table 6.2.6-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures 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.

Table 6.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury/mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including: Marine Mammal Protection Act (MMPA), Magnuson Stevens Fishery Conservation And Management Act (MSFCMA), MBTA, and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed Iowa 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 Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with mitigation is *less than significant*.	Habitat alteration in locations not designated as vital or critical for any period. Temporary losses to individual plants within cover types, or small habitat alterations take place in important habitat that is widely distributed and there are no cover type losses or cumulative effects from additional projects.	Sufficient habitat would remain functional to maintain viability of all species. No damage or loss of terrestrial, aquatic, or riparian habitat from project would occur.
	Geographic Extent	Regional effects observed within Iowa 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 Mitigation Measures Incorporated	Less than Significant	No Impact
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances, that lead to mortality, disorientation, the avoidance or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic 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 Iowa for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts, resulting in injury or mortality.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long term loss of migratory pattern/path, or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MSFCMA, MBTA, and BGEPA.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Temporary loss of migratory rest stops due to anthropogenic activities take place in important habitat that is widely distributed and there are no cumulative effects from additional projects.	No alteration of migratory pathways, no stress or avoidance of migratory paths/patterns due to project.
	Geographic Extent	Regional effects observed Iowa 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 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 mitigation is *less than significant*.	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success.
	Geographic Extent	Regional effects observed within Iowa for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning, or anthropogenic disturbances, that lead to stress, abandonment and loss of productivity for endemics or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated, or short-term effects that are reversed within one breeding season.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout Iowa.		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, 2016g)

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 6.2.6.3, 6.2.6.4, and 6.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 6.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Iowa.

6.2.6.3. Terrestrial Vegetation

Potential impacts to terrestrial vegetation occurring in Iowa are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are permanent or temporary loss or disturbance of individual plants. Based on the impact significance criteria presented in Table 6.2.6-1, direct injury or mortality impacts could be significant at the programmatic level if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, these events are expected to be relatively small in scale, and therefore would have *less than significant* impacts at the programmatic level. 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 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. About 81 percent of Iowa has experienced land use change and is no longer in pristine condition. However, about 7 percent of the state remains as relatively unfragmented forest (NRCS, 2010).

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. In general, these impacts are expected to be *less than significant* at the programmatic level due to the short-term, localized nature of the deployment activities. Further, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case BMPs and mitigation measures could be recommended and consultation with appropriate resource agencies, if required, would be undertaken to minimize or avoid potential impacts. Chapter 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.

Comments received on other regional Draft PEIS documents for the Proposed Action expressed concerns related to the potential impacts to vegetation from RF emissions. Some studies have indicated the potential for adverse effects to vegetation from RF emissions. As explained in Section 2.4, Radio Frequency Emissions, as well as the Wildlife portion of this Biological Resources Section, additional, targeted research needs to be conducted to more fully document the nature and effects of RF exposure, including the potential impacts to vegetation.

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. Overall, these impacts are expected to be *less than significant* at the programmatic level due to the short-term and small-scale nature of deployment activities.

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.

When non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. Natural or native community species evolve together into an ecosystem with many checks and balances that limit the population growth of any one species. These checks and balances include such things as: predators, herbivores, diseases, parasites, and other organisms competing for the same resources and limiting environmental factors. However, when an organism is introduced into an ecosystem in which it did not evolve naturally, those limits may not exist and its numbers can sometimes dramatically increase. The unnaturally large population numbers 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 (USFWS, 2012e). Iowa has enacted the Iowa Weed Law that regulates the control and destruction of noxious weeds, and most recently updated the noxious weed list in 2014 (Iowa Administrative Code, 2014). The IDALS is responsible for maintaining the statewide prohibited noxious weed list and updates to that list, as necessary.

The potential to introduce invasive plants within construction zones and during long-term site maintenance could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 19) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to terrestrial vegetation as a result of the introduction of invasive species.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to terrestrial vegetation resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result, at the programmatic level, 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,[131] and the nature as well as the extent of the habitats affected.

[131] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, 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 at the programmatic level.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* at the programmatic level on terrestrial vegetation because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: At the programmatic level, 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 at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

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 bodies of water would not impact terrestrial vegetation. However, impacts to terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects if BMPs and mitigation measures are not implemented.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct or indirect injury to plants, the vegetation loss, and invasive species effects.
- Wireless Projects
  - New Wireless Communication Towers 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 required 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* at the programmatic level due to the small-scale of expected deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the above-mentioned deployment impacts. The terrestrial vegetation that would be affected would depend on the, ecoregion, species' phenology, and the nature and extent of the habitats affected.

At the programmatic level, it is anticipated that there would be *no impacts* to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbing activity. Site maintenance, including mowing or herbicides, may result in *less than significant* effects at the programmatic level due to the small scale of expected activities. Accidental spills from maintenance equipment or pesticide runoff are anticipated to result in *less than significant* effects due to the limited nature of such activities and the likely small quantities of potentially harmful liquids used. If usage of heavy equipment or land clearing activities occur off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities, and invasive species could occur to terrestrial vegetation, however, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale 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, at the programmatic level, implementation of deployable technologies could result in *less than significant* impacts from land/vegetation clearing, excavation, and paving activities. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts. However, impacts are expected to remain *less than significant* at the programmatic level 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 at the programmatic level to terrestrial vegetation associated with routine operations and maintenance due to the relatively small scale of likely FirstNet project sites. The impacts can vary greatly among species, vegetative community, and geographic region, but are expected to remain *less than significant* at the programmatic level due to the temporary and small-scale nature of operational activities.

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, at the programmatic level, there would be *no impacts* to terrestrial vegetation as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.6.3, Terrestrial Vegetation.

6.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in Iowa are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle or vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 6.2.6-1, *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. Therefore, impacts are generally expected to be *less than significant* at the programmatic level, as discussed further below (except for birds which would be *less than significant with BMPs and mitigation measures incorporated*). Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

<u>Terrestrial Mammals</u>

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Iowa. 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, 2015f). Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur.

Entanglement in fences or other barriers could be a source of mortality or injury to terrestrial mammals, though entanglements would likely be isolated, individual events.

If tree-roosting bats, and particularly maternity colonies, are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small and would be dependent on the location and type of deployment activity, and tree removal. Site avoidance measures could be implemented to help avoid disturbance to bats.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and could violate MBTA and BGEPA. Generally, collision events occur to night-migrating birds, "poor" fliers (e.g., ducks), heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (Gehring, Kerlinger, & and Manville, 2011).

Avian mortalities or injuries could also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds could occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation and trenching, and other ground disturbing activities. Removal of trees during land clearing activities- could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for resting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state. Direct injury/mortality is not anticipated to be widespread or affect bird populations if BMPs are followed to avoid or minimize these effects.

Direct mortality and injury to birds of Iowa are not likely to be widespread or affect populations of species as a whole due to the small size of the likely FirstNet actions, however, DOI comments dated October 11, 2016[132] state that communication towers are "currently estimated to kill between four and five million birds per year", although collisions with towers have the potential to impact a large number of birds unless BMPs and mitigation measures are incorporated, tower collisions are unlikely to cause population-level impacts. (Treichel, 2016)Of particular concern is avian mortality due to collisions with towers at night, when birds can be attracted to tower obstruction lights. Research has shown that birds are attracted to steady, non-flashing red lights and are much less attracted to flashing lights, which can reduce migratory bird collisions by as much as 70%. The FAA has issued requirements to eliminate steady-burning flashing obstruction lights and use only flashing obstruction lights (insert references here to FAA Advisory Circulars AC 70/7460-1L, AC 150/5345-43H, (USDOT, 2016) and the Jan. 6, 2017 FAA notice titled Opportunities to Reduce Bird Collisions with Communications Towers While Reducing Tower Lighting Costs). See Chapter 19, BMPs and Mitigation Measures, for BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential impacts to birds from tower lighting. Site-specific analysis and/or consultation with FWS may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. If siting considerations, BMPs, and mitigation measures are implemented (Chapter 19), potential impacts could potentially be minimized. Additionally, potential impacts under MBTA and BGEPA could

[132] See Appendix F, Draft PEIS Public Comments, for the full text of the Department of Interior comments.

be addressed through BMPs and mitigation measures (including possible "take") in consultation with USFWS.

Reptiles and Amphibians

In Iowa, reptiles and amphibians occur in a wide variety of habitats across the state, with some having widespread distribution and others being limited to a smaller region or locations in the state (IDNR, 2012). 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 temporary and isolated, affecting only individual animals.

Terrestrial Invertebrates

Ground disturbance or land clearing activities as well as use of heavy equipment could result in direct injury or mortality to terrestrial invertebrates. However, deployment activities are expected to be temporary and isolated, thereby limiting the potential for direct mortality and likely affecting only a small number of terrestrial invertebrates. The terrestrial invertebrate populations of Iowa 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. As discussed in Section 6.2.6.3, Terrestrial Vegetation, the majority of Iowa has experienced land use change and habitats have been altered. Less than 10 percent (7 percent) of the state's lands remain as unfragmented forest land (NRCS, 2010).

Additionally, habitat loss could occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the Proposed Action would cause exclusion effects only in very special circumstances, as in most cases an animal could fly, swim, or walk to a nearby area that would provide refuge.

In general, potential effects of vegetation and habitat loss, alteration, or fragmentation are expected to be *less than significant* at the programmatic level because of the small-scale nature of expected deployment activities, as FirstNet would attempt to avoid these areas. These potential impacts are described for Iowa's wildlife species below. Chapter 19, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential effects of vegetation and habitat loss, alteration, or fragmentation are described for Iowa's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Iowa and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., bobcats) by decreasing the availability of forest for cover from predators or foraging. Loss of cover may increase predation on both breeding adults as well as their young. The loss, alteration, or fragmentation of forested habitat would also impact some small mammals (e.g., bats, foxes) that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by implementing BMPs and mitigation measures.

Birds

The direct removal of migratory bird nests is prohibited under the MBTA. The USFWS and IDNR 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 and vibration disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced in IBAs within the state as birds may temporarily avoid these areas (Hill, 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact on passerine[133] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration could have major impacts to species that migrate in large flocks and concentrate at stop overs (e.g., piping plovers). BMPs and mitigation measures, including nest avoidance during construction-related activities, would help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for Iowa's amphibians and reptiles typically consist of wetlands and, in some cases as with the timber rattlesnake, the surrounding upland forest. Impacts are expected to be *less than significant* at the programmatic level. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 19) could help to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 6.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed

[133]Passerines are an order of "perching" birds that have four toes, three facing forward and one backward, which allows the bird to easily cling to both horizontal and nearly vertical perches.

Action may also have effects onto Iowa's amphibian and reptile populations, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.[134]

Terrestrial Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many common terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state, therefore no significant effects to terrestrial invertebrates are expected (IDNR, 2012). Impacts to sensitive invertebrate species are discussed below in Section 6.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures would help to avoid or minimize the potential impacts. Overall, potential impacts are expected to remain *less than significant* at the programmatic level (except for birds and bats due to potential exposure to RF emissions, see below), due to the short-term nature and limited geographic scope of expected activities, as FirstNet would attempt to avoid these areas, though BMPs and mitigation measures could further help to avoid or minimize the potential impacts. Chapter 19, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Stress from repeated disturbances during critical time periods (e.g., roosting and mating) could reduce the overall fitness and productivity of young and adult terrestrial mammals. Indirect effects could occur to roosting bats from noise, vibrations, light, or human disturbance causing them to leave their roosting locations or excluding them from their summer roosting/maternity colony roosts. For example, some bat species establish summer roosting or maternity colonies in the same general area that they return to year and after year. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in *less than significant* impacts at the programmatic level (except for bats, see below) due to the limited extent and temporary nature of the deployment.

There are no published studies that document physiological or other adverse effects to bats from radio frequency (RF) exposure. However, because bats are similar ecologically and physiologically to birds, they have the potential to be affected by RF exposure in similar ways to birds (see the birds subsection below). One study demonstrated that foraging bats avoided areas exposed to varying levels of electromagnetic radiation compared with control sites, and attributed this behavior to the increased risk of overheating and echolocation interference caused by electromagnetic field exposure (Nicholls and Racey 2009). As stated below, experts emphasize that targeted field research needs to be conducted to more fully document the nature

[134] See Section 6.2.5, Wetlands, for a discussion of BMPs for wetlands.

and extent of effects of RF exposure on bats and other wildlife, and the implications of those effects on populations over the long term (Manville 2015 and 2016; Appendix G). FirstNet recognizes that RF exposure has the potential to adversely impact bats, particularly bats that communally roost or breed and nurture young in areas with RF exposure, and concurs with the need for further research. As such, and as a precaution, FirstNet would implement BMPs and mitigation measures that focus on siting towers away from known communal bat use areas to the extent practicable or feasible (described in Chapter 19, BMPs and Mitigation Measures). See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts.

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.

Research indicates that RF exposure may adversely affect birds. A comment letter on the Draft Programmatic Environmental Impact Statement for this region, presented by Dr. Albert Manville, former USFWS agency lead on avian-structural impacts, summarizes the state of scientific knowledge of the potential effects of RF exposure on wildlife, particularly migratory birds; the comment letter is presented in its entirety in Appendix G. RF exposure may result in adverse impacts on wildlife, although a distinct causal relationship between RF exposure and responses in wild animal populations has not been established. Further, important scientific questions regarding the mechanisms of impact, the exposure levels that trigger adverse effects, and the importance of confounding factors in the manifestation of effects, among other questions, remain unanswered (Manville 2016; Appendix G).

Research conducted to date under controlled laboratory conditions has identified a wide range of physiological and behavioral changes in avian and mammalian subjects, including embryonic mortality in bird eggs, genetic abnormalities, cellular defects, tumor growth, and reproductive and other behavioral changes in adult birds and rodents (Wyde 2016; Levitt and Lai 2010; Di Carlo et al. 2002; Grigor'ev 2003; Panagopoulos and Margaritas 2008).

Few studies of the effects of RF exposure on wild animal populations have been conducted due to the difficulty of performing controlled studies on wild subjects. Those that have been conducted are observational in nature (i.e., documenting of reproductive success and behavior in birds near RF-emitting facilities). These studies lack controls on exposure levels or other potentially confounding factors. Nevertheless, findings from these studies indicate reduced survivorship at all life stages; physiological problems related to locomotion and foraging success; and behavioral changes that resulted in delayed or unsuccessful mating in several species of nesting birds (Balmori 2005 and 2009; Balmori and Hallberg 2007; Manville 2016; Appendix G). Balmori (2005) documented effects as far as 1,000 feet from an RF source consisting of multiple cellular phone towers. Another study of wild birds conducted by Engels et al. (2014) documented that migratory birds are unable to use their magnetic compass in the presence of urban electromagnetic noise,[135] which can disrupt migration or send birds off course, potentially resulting in reduced survivorship.

Experts emphasize that targeted field research needs to be conducted to more fully document the nature and extent of effects of RF exposure on birds and other wildlife and the implications of those effects on wildlife populations over the long term (Manville 2015; Manville 2016; Appendix G). Such studies should be conducted over multiple generations and include controls to more clearly establish causal relationships, identify potential chronic effects, and determine threshold exposure levels. FirstNet recognizes that RF exposure may adversely impact wildlife, particularly birds that nest, roost, forage, or otherwise spend considerable time in areas with RF exposure, and concurs with the need for further research. As such, and as a precaution, FirstNet would implement BMPs and mitigation measures that focus on siting towers away from high bird use areas to the extent practicable or feasible (described in Chapter 19, BMPs and Mitigation Measures). See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts.

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 resulting in *less than significant* impacts at the programmatic level 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* at the programmatic level.

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 Iowa's amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below. Overall, potential impacts are anticipated to be *less than significant* at the programmatic level due to the small-scale and localized nature of expected activities, as FirstNet would attempt to avoid these areas. Potential effects to migration patterns of Iowa's amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates are described below. Chapter 19, BMPs and Mitigation Measures, provides a

[135] Urban electromagnetic noise is a term used to describe an area with a concentration of cell phone towers and users, which by sheer volume and level of use, creates a zone of electromagnetic noise.

listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts. See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts.

Terrestrial Mammals

Some large mammals (e.g., bobcats) will perform short seasonal migrations between foraging/breeding habitats and denning habitats. Some small mammals (e.g., bats) also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula.[136] Any clearance, drilling, and construction activities needed for network deployment, including noise and vibrations associated with these activities, has the potential to divert mammals from these migratory routes. Impacts could vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be *less than significant* given the short-term nature and limited geographic scope for individual activities. 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, piping plovers migrating through Iowa undertake some of the longest-distance migrations of all animals. According to the Iowa Audubon Society, a total of 94 IBAs have been identified in Iowa, including breeding,[137] migratory stop-over, wintering areas, feeding areas, and a variety of habitats and wintering rounds (Iowa Audubon Society, 2015). Many migratory routes are passed from one generation to the next. Impacts could vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, and impacts are expected to be *less than significant* at the programmatic level given the short-term nature and limited geographic scope for individual activities. Additionally, there is some evidence in the scientific literature that RF emissions could affect bird migration. Engels et al. (2014) documented that migratory birds are unable to use their magnetic compass in the presence of urban electromagnetic noise, which can disrupt migration or send birds off course, potentially resulting in reduced survivorship. It is unlikely that the limited amount of infrastructure, the amount of RF emissions generated by Project infrastructure, and the temporary nature of the deployment activities would result in impacts to large populations of migratory birds, but more likely that individual birds could be impacted. Chapter 19, BMPs and Mitigation Measures, provides a list of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential effects to migratory pathways.

[136] A location chosen by an animal for hibernation.

[137] Breeding range: "The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared" (USEPA, 2010a).

Reptiles and Amphibians

Several species of salamanders and frogs are known to seasonally migrate. For example, gray treefrogs (*Hyla versicolor*) inhabit forested areas in the eastern region of Iowa. During breeding season this species migrates to temporary ponds to lay its eggs (USGS, 2002).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but and impacts are expected to be *less than significant* at the programmatic level given the short-term nature and limited geographic scope for individual activities. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of Iowa's terrestrial invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which could affect the overall population of individuals. Overall, potential impacts are anticipated to be *less than significant* at the programmatic level due to the short-term and limited nature of expected activities (except for birds and bats which are anticipated to be *less than significant with BMPs and mitigation measures incorporated*, see below), as FirstNet would attempt to avoid these areas. Chapter 19, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts. See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and dens for large mammals, such as bobcats, has the potential to negatively affect body condition and reproductive success of mammals in Iowa.

There are no published studies that document adverse effects to bats from RF exposure. As stated above, experts emphasize that targeted field research needs to be conducted to more fully document the nature and extent of effects of RF exposure on bats and other wildlife, and the implications of those effects on populations over the long term (Manville 2015 and 2016; Appendix G). FirstNet recognizes that RF exposure has the potential to adversely impact bats, particularly bats that communally roost or breed and nurture young in areas with RF exposure, and concurs with the need for further research. As such, and as a precaution, FirstNet would implement BMPs and mitigation measures that focus on siting towers away from known communal bat use areas to the extent practicable or feasible (described in Chapter 19, BMPs and

Mitigation Measures). See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts.

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival. 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, vibrations, 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). Research conducted to date under controlled laboratory conditions has identified a wide range of physiological and behavioral changes in avian subjects, including embryonic mortality in bird eggs and reproductive changes in adult birds (Wyde 2016; Levitt and Lai 2010; Di Carlo et al. 2002; Grigor'ev 2003; Panagopoulos and Margaritas 2008). Laboratory studies conducted with domestic chicken embryos have shown that emissions at the same frequency and intensity as that used in cellular telephones have appeared to result in embryonic mortality (Di Carlo et al. 2002; Manville 2007). These studies suggest that RF emissions at low levels (far below the existing exposure guidelines for humans) (see Section 2.4.2, RF Emissions and Humans) may be harmful to wild birds; however, given the controlled nature of the studies and potential exposure differences in the wild, it is unclear how this exposure would affect organisms in the wild.

As such, and as a precaution, FirstNet would implement BMPs and mitigation measures that focus on siting towers away from high bird use areas to the extent practicable or feasible (described in Chapter 19, BMPs and Mitigation Measures) to help reduce bird mortalities associated with both RF emissions and tower collisions. See Section 2.4, Radio Frequency Emissions, for additional information on potential RF exposure impacts. The majority of FirstNet deployment or operation activities are likely to be small scale in nature. BMPs and mitigation measures as defined through consultation with USFWS for compliance with MBTA or BGEPA, or another appropriate regulatory agency, if required, could help to avoid or minimize any potential impacts. Environmental consequences pertaining to federally listed species will be discussed in Section 6.2.6.6, Threatened and Endangered Species.

Reptiles and Amphibians

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs and mitigation measures would help to avoid or minimize the potential impacts. 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 to reptiles and amphibians are expected to be *less than significant* at the programmatic level 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. The IDALS addresses invasive species of all types, including noxious weeds as previously mentioned. Two invasive insect species are known to occur in Iowa, the emerald ash borer and gypsy moth. The Asian longhorned beetle and the thousand cankers disease on black walnut are on a watch list for Iowa as they have not yet been detected but the potential exists for them to occur (IDALS, 2015a).

FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites; these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Therefore, potential impacts are expected to be *less than significant* at the programmatic level.

Potential invasive species effects to Iowa's wildlife are described below.

Terrestrial Mammals

FirstNet deployment or operation 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. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 19) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to terrestrial mammals as a result of the introduction of invasive species.

Birds

Invasive plant and pest species directly alter the landscape or habitat to a condition that is more favorable for other invasive species, and less favorable for native species and their habitats. FirstNet deployment activities could result in short-term or temporary changes to specific project sites; these sites are expected to return to their natural state in a year or two. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 19) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to birds as a result of the introduction of invasive species.

Reptiles and Amphibians

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. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities.

BMPs and mitigation measures (see Chapter 19) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to reptiles and amphibians as a result of the introduction of invasive species.

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 Iowa’s forest and agricultural resources. Species such as the gypsy moth and emerald ash borer are known to cause irreversible damage to native forests. The potential to introduce invasive invertebrates within construction zones and during long-term site maintenance could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 19) could help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to terrestrial invertebrates as a result of the introduction of invasive species.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result, at the programmatic level, in a range of impacts, from *no impacts* to *less than significant* impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, 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 and vibrations generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. At the programmatic level, it is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* on wildlife resources at the programmatic level because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: At the programmatic level, it is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources at the programmatic level.

Activities with the Potential to Have Impacts at the Programmatic Level

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 and vibrations, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects if BMPs and mitigation measures are not implemented.

  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Impacts may vary depending on the number or individual poles installed and the extent of ground disturbance, but could include direct injury/mortality of individual species as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise and vibration disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shore or banks of water bodies to accept submarine cables could potentially impact wildlife (see Section 6.2.4, 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/or indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to wildlife. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, and SOWs could result in direct injury/mortalities to wildlife on roadways. If external generators are used, noise and vibration disturbance could potentially impact migratory patterns of wildlife. RF hazards could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, and piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise and vibrations. 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* at the programmatic level given the small scale of likely individual FirstNet projects with the exception of impacts to birds and bats, which are expected to be *less than significant with BMPs and mitigation measures incorporated*.; however, some deployment activities could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the project type, location, ecoregion, the species' phenology, and the nature and extent of the habitats affected. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts. Therefore, impacts are expected to be *less than significant* at the programmatic level. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

At the programmatic level, it is anticipated that there would be *less than significant* impacts to wildlife resources associated with routine inspections of the Preferred Alternative. Site maintenance would be infrequent, including mowing or limited application of herbicides, may result in *less than significant* effects to wildlife including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. In particular, collisions with new cell towers that may be installed as part of the Preferred Alternative could increase avian mortality. As stated above, these impacts would likely be limited to individual wildlife species. DOI comments dated October 11, 2016[138], state communication towers are "currently estimated to kill between four and five million birds per year", although collisions with towers have the potential to impact a large number of birds unless BMPs and mitigation measures are incorporated, tower collisions are unlikely to cause population-level impacts. (Treichel, 2016) Therfore, impacts to birds may result in *less than significant* impacts with BMPs and mitigation measures added.

Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and would therefore likely be *less than significant* at the programmatic level. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

[138] See Appendix F, Draft PEIS Public Comments, for the full text of the Department of Interior comments.

Alternatives Impact Assessment

The following section assesses potential impacts to wildlife resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As described above, implementation of deployable technologies could result in *less than significant* impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain *less than significant* because deployment activities are expected to be temporary, likely affecting only a small number of wildlife. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *less than significant* impacts at the programmatic level because deployable activities are expected to be temporary and 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.

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, at the programmatic level, there would be *no impacts* to wildlife resources as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.6.4, Terrestrial Wildlife.

6.2.6.5. Fisheries and Aquatic Habitats

Potential impacts to fisheries and aquatic habitats occurring in Iowa 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, 2012f).

Based on the impact significance criteria presented in Table 6.2.6-1, *less than significant* impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable but minimal for some FirstNet projects, individual behavior of fish species would be short-term, and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed. BMPs and mitigation measures could help to avoid or minimize potential impacts to fisheries and aquatic invertebrate population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

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

Depending on the location, construction of new infrastructure and long-term facility maintenance could result in the shoreline habitat alteration in localized areas; in some instances, the permanent loss of riparian vegetation could occur, which could lead to water quality impacts and in turn aquatic habitat alteration. Habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location depending on the nature of the deployment activity, therefore impacts are expected to be *less than significant* at the programmatic level. 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. These impacts are expected to be *less than significant* at the programmatic level due to the limited extent and temporary nature of the deployment. BMPs and mitigation measures to protect water resources (see Section 6.2.4, Water Resources) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. For example, restrictions or alterations to waterways could alter migration patterns, limit fish passage, or affect foraging and spawning site access. Impacts are expected to vary depending on the species, time of year, and duration of deployment, and are anticipated to be *less than significant* because they would be localized and at a small scale. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which could affect the overall population of individuals. Restrictions to spawning/breeding areas for fish and aquatic invertebrates and the alteration of water quality through sediment infiltration, obstruction of natural water flow, or loss of submerged vegetation resulting from the deployment of various types of infrastructure, are expected to be *less than significant* at the programmatic level due to the limited extent and temporary nature of the deployment, though BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive plants within construction zones 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; although these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers, therefore impacts are expected to be *less than significant* at the programmatic level. Overall, these potential impacts are expected to be *less than significant* at the programmatic level due to the small-scale, localized nature of deployment activities. BMPs and mitigation measures (see Chapter 19) would help to avoid or minimize the potential for introducing invasive species during implementation of the Proposed Action as well as minimize effects to aquatic environments as a result of the introduction of invasive species.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result, at the programmatic level, in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, the following are expected to have *no impacts* to fisheries and aquatic habitats under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise and vibrations, 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. At the programmatic level, it is anticipated that effects to fisheries would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* on fisheries and aquatic habitats at the programmatic level because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: At the programmatic level, 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, at the programmatic level, this activity would have no impact on the aquatic environment.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources that support fish. Disturbance, including noise and vibrations, associated with the above activities could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects if BMPs and mitigation measures are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shores or banks of water bodies 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 and vibrations, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to fisheries and aquatic habitats. However, if new power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of RF emissions and potential impacts, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be *less than significant* at the programmatic level due to the small scale of deployment activities and the limited number of aquatic species expected to be impacted. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the 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.

At the programmatic level, it is anticipated that there would be *less than significant* impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance that might include accidental spills from maintenance equipment or pesticide runoff near fish habitat are anticipated to result in *less than significant* effects to fisheries and aquatic habitats due to the limited nature of such activities and the likely small quantities of potentially harmful liquids used. Fisheries and aquatic habitat could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition, the presence of new access roads and transmission line ROWs near water resources that support fish may increase human use of the surrounding area, which could increase disturbance to fisheries and aquatic habitat, resulting in effects to migratory pathways, indirect death/mortalities, reproductive effects, as well as the potential and spread of invasive species as explained above. Fisheries and aquatic habitat may also be impacted if increased access leads to an increase in the legal or illegal take of biota. However, impacts are expected to be *less than significant* at the programmatic level due to the small scale of expected activities with the potential to affect fisheries and aquatic habitat. As a result of the small scale, only a limited number of individuals are anticipated to be impacted; furthermore, habitat impacts would also be minimal in scale. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to fisheries and aquatic habitats associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Therefore, potential impacts to fisheries and aquatic habitats as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts from habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain *less than significant* at the programmatic level due to the limited nature of expected deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As explained 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 areas. Regardless, as with the Preferred Alternative, at the programmatic level, it is anticipated that there would be *less than significant* impacts to fisheries and aquatic habitats associated with routine and maintenance due to the limited nature of expected deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

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, at the programmatic level, there would be *no impacts* to fisheries and aquatic habitats as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.6.5, Fisheries and Aquatic Habitats.

6.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Iowa associated with deployment and operation of the Proposed Action and alternatives. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on threatened and endangered species and their habitat were evaluated using the significance criteria presented in Table 6.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined, at the programmatic level, as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. These impact categories are comparable to those defined in the *Endangered Species Consultation Handbook* and are described in general terms below (FWS, 1998):

- *No effect* means that no listed resources would be exposed to the action and its environmental consequences.
- *May affect, not likely to adversely affect* means that all effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact and include those effects that are undetectable, not measurable, or cannot be evaluated. Discountable effects are those extremely unlikely to occur.
- *May affect, likely to adversely affect* means that listed resources are likely to be exposed to the action or its environmental consequences and would respond in a negative manner to the exposure.

Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes across the state, the potential impacts to threatened and endangered species addressed below are presented as a range of possible impacts.

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 6.2.6-2, any direct injury or mortality of a listed species at the individual-level could be *potentially significant* as well as any impact that has more than a negligible potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency. Direct injury/mortality environmental concerns pertaining to federally listed terrestrial mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in Iowa are described below.

Table 6.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	May Affect, Not Likely to Adversely Affect	No Effect
Injury/Mortality of a Listed Species	Magnitude or Intensity	As per the ESA, this impact threshold applies at the individual level so applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under likely to adversely affect category). Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Includes permitted take.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species.	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to infrequent, temporary, and short-term effects.	
Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success of a listed species.	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success.	No measurable effects on listed species.
	Geographic Extent	Reduced breeding success of a listed species at any geographic extent.	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success of listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success of a listed species.	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success of a listed species within a breeding season.	

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat.
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Terrestrial Mammals

One endangered and one threatened mammal species are federally listed and known to occur in the Iowa; they include the Indiana bat (*Myotis sodalis*) and northern long-eared bat (*Myotis septentrionalis*). Direct mortality or injury to the federally listed Indiana bat or northern long-eared bat could occur if tree clearing activities occurred at roosting sites while bats were present (USFWS, 2015ae) (USFWS, 2015e). While projects would not likely directly affect winter hibernacula (e.g., caves), human disturbance in and around these sites when bats are present could lead to adverse effects to these species; when disturbed by noise, vibrations, or light, bats awaken resulting in a loss of body fat needed to help them survive in the spring (USFWS, 2012a). Impacts would likely be isolated, individual events and therefore *may affect, but are not likely to adversely affect*, a listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Birds

One endangered and one threatened bird species are federally listed and known to occur in Iowa: the least tern (*Sterna antillarum*) and piping plover (*Charadrius melodus*). Depending on the project types and location, direct mortality or injury to these birds could occur from collisions or electrocutions with manmade cables and wires, vehicle strikes, or by disturbance or destruction of nests during ground disturbing activities. However, these potential impacts *may affect, but are not likely to adversely affect*, listed species as FirstNet would attempt to avoid deployment activities areas where listed species 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, may be implemented as appropriate to further minimize potential impacts.

Fish

Two endangered fish species are federally listed and known to occur in Iowa; they include the pallid sturgeon (*Scaphirhynchus albus*) and Topeka shiner (*Notropis topeka*). The majority of FirstNet deployment projects would not occur in an aquatic environment. Direct mortality or injury to this species are could occur from entanglements resulting from the Proposed Action are unlikely as the majority of FirstNet deployment projects would not occur in the aquatic environment. However, these potential impacts *may affect, but are not likely to adversely affect*, listed species as FirstNet would attempt to avoid deployment activities areas where listed species 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, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

No federally listed reptiles or amphibians are known to occur in Iowa. Therefore, no injury or mortality effects to federally threatened and endangered amphibians are expected as a result of the Proposed Action.

Invertebrates

Five endangered and one threatened invertebrate species are federally listed and known to occur in Iowa; they include the Dakota skipper (*Hesperia dacotae*), Higgins' eye pearlymussel (*Lampsilis higginsii*), Iowa Pleistocene snail (*Discus macclintocki*), Poweshiek skipperling (*Oarisma poweshiek*), sheepnose mussel (*Plethobasus cyphyus*), and spectaclecase mussel (*Cumberlandia monodonta*). Direct mortality or injury could occur to the Iowa Pleistocene snail, Dakota skipper, or Poweshiek skipperling if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. However, these potential impacts *may affect, but are not likely to adversely affect*, listed species as FirstNet would attempt to avoid deployment activities areas where listed species occur.

The majority of FirstNet deployment projects would not occur in an aquatic environment. Direct mortality or injury to the Higgins' eye pearlymussel, sheepnose mussel, and spectaclecase mussel are unlikely but could occur from minor ground disturbance resulting from the Proposed Action.

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Plants

Five threatened plant species are federally listed and known to occur in the Iowa; they include the eastern prairie fringed orchid (*Platanthera leucophaea*), Mead's milkweed (*Asclepias meadii*), northern wild monkshood (*Aconitum noveboracense*), prairie bush-clover (*Lespedeza leptostachya*), and western prairie fringed orchid (*Platanthera praeclara*). 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. However, these potential impacts *may affect, but are not likely to adversely affect*, listed species as FirstNet would attempt to avoid deployment activities areas where listed species occur. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduces 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, amphibians, fish, invertebrates, and plants with known occurrence in Iowa are described below.

Terrestrial Mammals

Noise, vibrations, light, and other human disturbances associated with the Proposed Action could adversely affect federally listed terrestrial mammals within or in the vicinity of Project activities. Impacts would be directly related to the frequency, intensity, and duration of these activities, however, they are anticipated to be small-scale and localized. Additionally, FirstNet would attempt to avoid these areas. Therefore, potential impacts *may affect, but are not likely to adversely affect*, listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Birds

Noise, vibrations, light, or other human disturbance within nesting areas could cause federally listed birds to relocate to less desirable locations, or cause stress to individuals reducing survival and reproduction. However, these potential impacts *may affect, but are not likely to adversely affect*, listed species as FirstNet would attempt to avoid deployment activities areas where listed species 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, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

No federally listed reptiles or amphibians are known to occur in Iowa. 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, vibrations), especially during spawning activity, and changes in water quality could cause stress resulting in lower productivity (see Section 6.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects to federally listed fish species in Iowa are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts *may affect, but are not likely to adversely affect*, listed species as FirstNet would attempt to avoid deployment activities areas where listed species 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, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in water quality from ground disturbing activities could cause stress resulting in lower productivity for federally listed mussels known to occur in Iowa. In addition, introduction of invasive aquatic species could indirectly affect mussels as a result of fish populations that they rely on for their reproductive cycle being altered (USFWS, 2012e). Impacts associated with deployment activities are expected to result in *less than significant* changes to water quality. For terrestrial species such as the Poweshiek skipperling, habitat loss and habitat fragmentation are the primary reasons for species decline, partially due to removal of areas where individuals can mate. FirstNet would attempt to avoid those areas known to contain listed invertebrates. Potential impacts *may affect, but are not likely to adversely affect*, listed species due to the limited extent and temporary nature of the deployment. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, may be implemented; in addition, BMPs and mitigation measures (Chapter 19) 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, may be implemented. Additionally, FirstNet would likely attempt to avoid known locations of listed plants. If avoidance was not possible, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts

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 Iowa are described below.

Mammals

Habitat loss or alteration, particularly from fragmentation or invasive species, could affect breeding and foraging sites of the federally listed terrestrial mammals, resulting in reduced survival and productivity. However, the localized nature of disturbances during deployment activities are not anticipated to stress federally listed terrestrial mammals. Ground disturbing activities could impact food sources for the federally listed terrestrial mammals. Further, increased human disturbance, noise, vibrations, and vessel traffic could cause stress to listed species, causing them to abandon breeding locations or alter migration patterns. Terrestrial mammals have the capacity to divert from sound sources during feeding and migration. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts *may affect, but would likely not adversely affect,* these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, 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. For example, piping plover use sites throughout Iowa as stopover and nesting habitat. Piping plovers migrate from the Northern Great Plains, Northern Atlantic Coast, and Great Lakes Area to the coastal habitats in the south (IDALS, 2015b). Disturbance in stopover, foraging, or breeding areas (visual, vibrations, or noise) or habitat loss/fragmentation could cause stress to individuals causing them to abandon areas for less desirable habitat and potentially reduce over fitness and productivity. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts *may affect, but would likely not adversely affect*, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

There are no listed reptiles or amphibians in the state, therefore no behavioral effects would occur.

Fish

Changes in water quality as a result of ground disturbing activities could impact food sources for the federally listed fish species in Iowa. Further, increased human disturbance, noise, vibrations, and vessel traffic could cause stress to these species causing them to abandon spawning locations or altering migration patterns. Behavioral changes to the pallid sturgeon and Topeka shiner are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts *may affect, but would likely not adversely affect*, these species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in water quality, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed mussels 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. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts *may affect, but would likely not adversely affect*, these species. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Plants

No behavioral effects to federally listed plants are expected as a result of the Proposed Action.

Loss or Degradation of Designated Critical Habitat

Effects to designated critical habitat and any of its essential features that could diminish the value of the habitat for the listed species or its survival and recovery would be considered an adverse effect and could be *potentially significant*. Depending on the species or habitat, the adverse effect threshold would vary for geographic extent. In some cases, although unlikely to occur, large-scale impacts could diminish the functions and values of the habitat, while in other cases small-scale change could lead to potential adverse effects. For example, impacts to designated critical habitat for a listed species that is only known to occur in one specific location geographically. Potential effects to federally listed terrestrial mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with designated critical habitat in Iowa are described below.

Terrestrial Mammals

No designated critical habitat occurs for terrestrial mammals in Iowa. 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

No designated critical habitat occurs for birds in Iowa. 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.

Reptiles and Amphibians

No designated critical habitat occurs for reptiles or amphibians in Iowa. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Fish

One federally listed fish in Iowa has federally designated critical habitat. Critical habitat for the Topeka shiner was designated in Raccoon River Watershed, Boone River Watershed, and Rock River Watershed. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts *may affect, but would likely not adversely affect*, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

One federally listed invertebrate species has designated critical habitat. Critical habitat for the Poweshiek skipperling has been designated as 11 units in Cerro Gordo, Dickinson, Emmet, Howard, Kossuth, and Osceola counties. Land clearing, excavation activities, and other ground disturbing activities in these regions of Iowa could lead to habitat loss or degradation, which could lead to adverse effects to these invertebrates depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt to avoid areas where these species are known to occur; therefore, potential impacts *may affect, but would likely not adversely affect*, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Plants

No designated critical habitat occurs for plants in Iowa. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential effects to threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result, at the programmatic level, in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions. Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. The threatened and endangered species that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

Activities Likely to Have No Effect at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no effect on threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise and vibrations, 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, at the programmatic level, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* on threatened and endangered species or their habitat at the programmatic level because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: At the programmatic level, 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 or endangered species because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact protected species, it is anticipated that this activity would have no impact on protected species at the programmatic level.

Activities with the Potential to Affect Listed Species at the Programmatic Level

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g., reptiles, mollusks, small mammals, and young), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (e.g., ground-nesting birds). Disturbance, including noise and vibrations, 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 and vibration disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shores or banks of water bodies to accept submarine cables could potentially impact threatened and endangered species and their habitat, particularly aquatic species (see Section 6.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical time periods, reproductive effects and behavioral changes could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be *no impacts* to threatened and endangered species or their habitats at the programmatic level. 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 RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower; FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers or structural hardening are

required, impacts could be similar to new wireless construction. Hazards related security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise and vibration disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  Deployment of drones, balloons, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. These impacts may affect, but are not likely to adversely affect, protected species 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.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The threatened and endangered species that would be affected would depend on the species' phenology and the nature and extent of the habitats affected.

At the programmatic level, it is anticipated that operational impacts may affect, but are not likely to adversely affect threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect threatened and endangered species, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species may be affected, but are not likely to be adversely affected 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, 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. Impacts are anticipated to be *less than significant* at the programmatic level 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, may be implemented as appropriate to further minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential effects 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 effects 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. Impacts are anticipated to be *less than significant* at the programmatic level 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, 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, at the programmatic level, it is anticipated that operational 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. Impacts are anticipated to be *less than significant* at the programmatic level 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, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no effects to threatened and endangered species as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.6.6, Threatened and Endangered Species and Species of Concern.

6.2.7. Land Use, Recreation, and Airspace

6.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Iowa 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.

6.2.7.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on land use, recreation, and airspace resources were evaluated using the significance criteria presented in Table 6.2.7-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures 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.

6.2.7.3. Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of rights-of-way or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the right-of-way, easement, or access road. These characteristics, such as the length, width, and location could change the existing land use to another category or result in the short- or long-term loss of the existing land use.

Based on the impact significance criteria presented in Table 6.2.7-1, *less than significant* impacts would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Table 6.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with 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 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, vibrations, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites.	Effect that is *potentially significant*, but with mitigation is *less than significant*.	Small reductions in visitation or duration of recreational activity.	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less Than Significant with Mitigation 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

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 6.2.7-1, at the programmatic level, *less than significant* impacts would be anticipated as any new land use would be small scale; only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

The deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement could influence access to public or private recreation land or activities. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features. In the long-term, the deployment and installation of poles, towers, structures, or other aboveground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 6.2.7-1, at the programmatic level, *less than significant* impacts would be anticipated as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features could temporarily impact enjoyment of recreation land. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise and vibration impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 6.2.7-1, at the programmatic level, *less than significant* impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Impacts could include air routes or flight paths, available flight altitudes, disruption of normal flight patterns, and restrictions to flight activities. Construction of new towers or alternations to existing towers could obstruct navigable airspace depending on the tower location. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 6.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. As drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period, FirstNet would not impact airspace resources.

6.2.7.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure, and the specific deployment requirements, some activities would result in potential impacts to land use, recreation, and airspace resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result, at the programmatic level, 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 at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, the following are likely to have *no impacts* to land use, recreation, and airspace resources under the conditions described below:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: See Activities Likely to Have Impacts below.
    - Recreation: See Activities Likely to Have Impacts below.

  - Airspace: *No impacts* to airspace would be anticipated , at the programmatic level, since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 6.1.7.5 Obstructions to Airspace Considerations).
- Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
  - Land Use: At the programmatic level, it is anticipated that there would be *no impacts* to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: See *Activities Likely to Have Impacts* below.
  - Airspace: At the programmatic level, it is anticipated that there would be *no impacts* to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 6.1.7.5 Obstructions to Airspace Considerations).
- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
  - Land Use: At the programmatic level, 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 at the programmatic level 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: If new pole replacement remains in the same location and of the same height as the current pole, then there would be no expected impact on airspace at the programmatic level,.
- 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: At the programmatic level, 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 and installation of new equipment in existing huts would not impact recreation at the programmatic level.
  - Airspace: Lighting of dark fiber would have *no impacts* on airspace at the programmatic level,. If required, and if installation of new associated equipment is within the footprint of the existing huts, then there would be no expected impact on airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in or near bodies of water and the constructing landings and/or facilities on shores and banks of water bodies to accept submarine cable.
  - Land Use: See *Activities Likely to Have Impacts* below.

- Recreation: See *Activities Likely to Have Impacts* below.
- Airspace: At the programmatic level, the installation of cables in or near bodies of water and construction of landings/facilities on shores and banks of water bodies would not impact flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 6.1.7.5 Obstructions to Airspace Considerations).

- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would occur in existing boxes or huts. The section below addresses potential impacts to land use, recreation resources, and airspace if deployment of new boxes, huts, or access roads is required.
  - Land Use: See *Activities Likely to Have Impacts* below.
  - Recreation: See *Activities Likely to Have Impacts* below.
  - Airspace: At the programmatic level, *no impacts* to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 6.1.7.5 Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower
    - Land Use: At the programmatic level, 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: At the programmatic level, 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: At the programmatic level, *no impacts* to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
    - Airspace: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet Above Ground Level (AGL) or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 6.1.7.5 Obstructions to Airspace Considerations.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: At the programmatic level, 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: At the programmatic level, 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: At the programmatic level, 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 have *no impacts* on land use, access to or enjoyment of recreation, or air traffic patterns, at the programmatic level, it is anticipated that this activity would have no impact on land use, airspace, or recreation.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential deployment-related impacts to land use, recreation resources, or airspace as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: *No impacts* are anticipated – see previous section.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas.
    - Land Use: *No impacts* are anticipated – see previous section.

    - Recreation: Installation of fiber optic cable in existing conduits occurs in previously disturbed areas, which may include areas used for recreational purposes. It is possible that access to recreational lands or activities may be restricted during the deployment phase or a portion of the operations phase.
    - Airspace: *No impacts* are anticipated – see previous section.
- New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) rights-of-way or easements and the potential construction of access roads.
    - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed rights-of-way or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
    - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
    - Airspace: *No impacts* are expected as utility poles would be well below 200 feet. Consultation with the FAA and the state is unlikely unless the new poles meet the criteria listed in Section 6.1.7.5 Obstructions to Airspace Considerations. An Obstruction Evaluation and Airport Airspace Analysis (OE/AAA) could be required for the FAA to determine if the proposed construction does affect the airspace or flight patterns of an airport if the aerial fiber optic plant is located in proximity to one of Iowa's airports.
- New Build – Submarine Fiber Optic Plant: Installing cables in or near bodies of water and the constructing landings and/or facilities on shores and banks of water bodies to accept submarine cable.
    - Land Use: Deployment activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment may temporarily restrict recreation on or within 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 ft. 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 Iowa's airports.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
    - Land Use: *No impacts* are anticipated – see previous section.
    - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airports.
- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: *No impacts* are anticipated – see previous section.
    - Recreation: *No impacts* are anticipated – see previous section.

        - Airspace: Implementation of Deployable Aerial Communications Architecture could result in potential impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near Iowa airports (See obstruction criteria in Section 6.10.5.3 Obstructions to Airspace Considerations). Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones and 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: At the programmatic level, it is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace are expected to be *less than significant* at the programmatic level due to the temporary and small-scale nature of deployment activities. Additionally, FirstNet (or its network partners), would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. At the programmatic level, it is anticipated that there would be *no impacts* to land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections. If routine maintenance or inspection activities would conflict with existing or surrounding land uses, impact recreation resources, or conflict with airspace, impacts could result as explained above. 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.

6.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

While a single deployable technology may have an insignificant 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 for long periods of time. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected, however, impacts would be *less than significant* at the programmatic level due to the temporary nature of likely deployment activities. If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, FirstNet (or its partners) would consult with the FAA to determine how to proceed. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that, at the programmatic level, there would be *no impacts* to land use, recreation resources, or airspace associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for temporary, short-term inspections because there would be no ground disturbance, no airspace activity, and no access restrictions to recreational lands. Operation of deployable technologies would result in impacts to 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, 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* at the programmatic level due to the temporary nature of deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be *no impacts* to land use, recreation resources, or airspace at the programmatic level. Environmental conditions would therefore be the same as those described in Section 6.1.7, Land Use, Recreation, and Airspace.

6.2.8. Visual Resources

6.2.8.1. Introduction

This section describes potential impacts to visual resources in Iowa 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.

6.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 6.2.8-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures 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 6.2.8-1: Impact Significance Rating Criteria for Visual Resources at the Programmatic Level

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.

6.2.8.3. Description of Environmental Concerns

Adverse Change in Aesthetic Character of Scenic Resources or Viewsheds

A primary concern during and following construction of structures, towers, roads or other permanent features is the long-term disruption of scenery and viewsheds. In Iowa, residents and visitors travel to many National Park Service Units and state parks, such as Rock Creek State Park to enjoy the lake beaches and lake vistas, or the Loess Hills NNL. 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. Iowa regulates impacts to visual resources for historic properties through their State Historic Preservation Office to identify, preserve, and protect the state's historic resources and administers the state's National Register of Historic Places as well as the state's inventory of historic properties (State Historical Society of Iowa, 2013a). If new towers were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Based on the impact significance criteria presented in Table 6.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered *potentially significant* at the programmatic level if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. The majority of FirstNet deployment activities would not cause negative impacts to the aesthetic character to a noticeable degree; therefore, at the programmatic level, *less than significant* impacts would be anticipated. However, some projects, such a towers, facilities, or infrastructure could cause a negative impact on the aesthetic character of local viewsheds depending on their size and location.

Nighttime lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility that caused regional impacts or permanent changes to night sky conditions, those effects would be considered *potentially significant*.

Based on the impact significance criteria presented in Table 6.2.8-1, lighting that illuminates the night sky, diminishes night sky viewing over long distances, and persists over the long-term would be considered *potentially significant*. Although likely FirstNet actions are expected to be small-scale, certain discrete locations may experience *potentially significant* impacts to night skies, although potentially minimized to *less than significant with implementation of BMPs and mitigation measures* at the programmatic level, as defined in Chapter 19, BMPs and Mitigation Measures. See Chapter 19, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

6.2.8.4. 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, at the programmatic level, 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 at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, 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. At the programmatic level, 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.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* at the programmatic level on visual resources. If required, and if done in existing huts with no ground disturbance, installation of new associated equipment would have *no impacts* on visual resources at the programmatic level. The section below addresses potential impacts to visual resources if construction of new huts or other equipment is required.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: At the programmatic level, 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 as long as 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 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 visual resources, it is anticipated that, at the programmatic level, this activity would have *no impact* on visual resources.

Activities with the Potential to Have Impacts at the Programmatic Level

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 and location of the project; installation of a hut or POP would be permanent, whereas ground disturbing activities would be short-term. In most cases, development in or next to existing roadways would not affect visual resources unless vegetation was 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 was 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 and near bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be highly 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. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units, structural hardening, and 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 results in vegetation removal or areas of surface disturbance.

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. Impacts to visual resources are anticipated to be *less than significant* at the programmatic level due to the temporary and small-scale nature of deployment activities. As discussed above, potential impacts to night skies from lighting are expected to be *less than significant with BMPs and mitigation measures incorporated* at the programmatic level. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. At the programmatic level, it is anticipated that there would be *no impacts* to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park would be *less than significant with BMPs and mitigation measures* *incorporated* during operations. Additionally, FirstNet would work closely with the NPS to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

6.2.8.5. Alternatives Impact Assessment

The following section assesses potential impacts to visual resources associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with the 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, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be *less than significant*, as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. Chapter 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, at the programmatic level,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* at the programmatic level. 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. 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. 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, at the programmatic level, there would be *no impacts* to visual resources as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 9.1.8, Visual Resources.

6.2.9. Socioeconomics

6.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Iowa 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.

6.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 6.2.9-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures incorporated, less than significant,* or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to socioeconomics addressed in this section are presented as a range of possible impacts.

Table 6.2.9-1: Impact Significance Rating Criteria for Socioeconomics at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Indiscernible impact on property values and/or rental fees.	*No impacts* to real estate in the form of changes to property values or rental fees.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Indiscernible economic change.	No change to tax revenues, wages, major industries, or direct spending.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated cities/towns.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
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
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes in population number or composition	Magnitude or Intensity	Substantial increases in population, or changes in population composition (age, race, gender).	Effect that is *potentially significant*, but with mitigation is *less than significant*.	Minor increases in population or population composition.	No changes in population or population composition.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

6.2.9.3. Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts related to Changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values due to below average public safety communication services. Improved services would reduce response times and improve responses (provide a better fit of the response to the need). These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Existing Environment, property values vary across Iowa. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $178,000 in the greater Iowa City area, to just over $85,000 in the Iowa portion of the Burlington area. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts related to Changes in Spending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party. 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* at the programmatic level. 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. Bureau of Justice Statistics, 2011). 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* at the programmatic level. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Existing Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary somewhat across Iowa. The average annual unemployment rate in 2014 was 4.4 percent, considerably lower than the national rate of 6.2 percent. All but one of Iowa's counties had unemployment rates below the national average (that is, better employment performance). The northwestern portion of the state had a somewhat greater density of counties within the lowest range (less than 4.0 percent) of unemployment rates.

Large companies that win major contracts for deploying and operating the NPSBN may have concentrations of employees in some specific locations; for instance, engineers and other system designers may be located in one or a few specific offices. While such employment concentrations could be important to specific communities, these and other employment impacts would still not be significant based on the criteria in Table 6.2.9-1 because they would not constitute a "high level of job creation at the state or territory level."

Changes in Population Number or Composition

In general, changes in population numbers occur when employment increases or decreases to a degree that affects the decisions of workers on where they can find employment; that is, when workers and their families move to or leave an area because of employment opportunities or the lack thereof. As noted above, deployment and operation of the NPSBN is likely to generate new employment opportunities (directly and indirectly), but employment changes would not be large enough in any state to be considered significant. Therefore, it is highly unlikely that the NPSBN would lead to significant changes in population numbers according to the significance criteria table above. Further, it is unlikely that the NPSBN would lead to any measurable changes in population numbers in any geographic areas, with the possible exception of cities where companies that win major NPSBN contracts establish centers for NPSBN deployment and operation activities. Smaller numbers of employees in any area would not produce measurable population changes because population is always in flux due to births, deaths, and in-migration and out-migration for other reasons.

Population composition refers to age, gender, race, ethnicity, and other characteristics of the individuals making up a population. Given the low potential for changes to population numbers, it is highly unlikely that the NPSBN would lead to any changes in population composition.

6.2.9.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 6.2.9-1.

Activities Likely to Have No Impacts at the Programmatic Level

- 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, at the programmatic level, this activity would have no impact on socioeconomic resources.

Activities with the Potential to Have Impacts at the Programmatic Level

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below indicates which of the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate;
- Changes to Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
    - 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* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be

small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment through existing or new boxes or huts would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.

- New Build – Aerial Fiber Optic Plant: Pole/structure installation would have the following types of socioeconomic impacts:
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus the impacts would be *less than significant* at the programmatic level.
    - 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* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be *less than significant* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:

    - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., parked vehicles in a new parking lot), equipment maintenance activities at such facilities may generate noise and vibrations, 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* at the programmatic level.
    - 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* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: At the programmatic level, 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* at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a *less than significant* number of jobs regionally and statewide.

In general, the abovementioned activities would have *less than significant* beneficial socioeconomic impacts. To the extent that certain activities could have adverse impacts to property values, those impacts are also expected to be *less than significant*, as described above. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

The discussion above characterized the impacts of each type of activity. The socioeconomic impacts of all activities considered together would also be *less than significant* because 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. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. 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* at the programmatic level.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would be *less than significant* as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and 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.

6.2.9.5. Alternatives Impact Assessment

The following section assesses potential impacts to socioeconomics associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, all deployment activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, such as generation of business income and employee wages, and creation or sustainment of jobs. The impacts would be small for each activity, and therefore less than significan at the programmatic level t.

Deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, would require storage, staging, and launch/landing areas. Development or enlargement of these facilities could have adverse impacts on nearby property values. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be implemented in greater numbers and over a larger geographic extent. These potential impacts are anticipated to be *less than significant* as described above. Chapter 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 because they are small individually, overall impacts would be *less than significant* at the programmatic level.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise, vibrations, and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be *less than significant* as they would be limited to a relatively small number of sites within the region and 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.

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, at the programmatic level, there would be *no impacts* to socioeconomics as a result of the No Action Alternative. Socioeconomic conditions would therefore be the same as those described in Section 6.1.9, Socioeconomics.

6.2.10. Environmental Justice

6.2.10.1. Introduction

This section describes potential impacts to environmental justice in Iowa 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.

6.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 6.2.10-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures incorporated, less than significant,* or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to environmental justice addressed in this section are presented as a range of possible impacts.

Table 6.2.10-1: Impact Significance Rating Criteria for Environmental Justice at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Effects associated with other resource areas (e.g., human health and safety, cultural resources, socioeconomics) that have a disproportionately high and adverse impact on low-income populations and minority populations	Magnitude or Intensity	Direct and disproportionately high and adverse effects on environmental justice communities (as defined by EO 12898) that cannot be fully mitigated.	Effect that is *potentially significant*, but with mitigation is *less than significant*.	Direct effects on environmental justice communities (as defined by EO 12898) that are not disproportionately high and adverse, and therefore do not require mitigation.	No direct effects on environmental justice communities, as defined by EO 12898.
	Geographic Extent	Effects realized within counties at the Census Block Group level.		Effects realized within counties at the Census Block Group level.	Effects realized within counties at the Census Block Group level.
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

6.2.10.3. Description of Environmental Concerns

Effects Associated with Other Resource Areas That Have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment." (CEQ, 1997) Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise and Vibrations, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, vibrations, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. Indian tribes are considered environmental justice populations (CEQ, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both* "adverse" and "disproportionately high" in their incidence on environmental justice populations relative to the general population (CEQ, 1997). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences (Section 6.2.9).

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

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* at the programmatic level. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Existing Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary somewhat across Iowa. The average unemployment rate in 2014 was 4.4 percent, considerably lower than the national rate of 6.2 percent. All but one of Iowa's counties had unemployment rates below the national average (that is, better employment performance). The northwestern portion of the state had a somewhat greater density of counties within the lowest range (less than 4.0 percent) of unemployment rates.

Site-specific analysis may be required depending on the site conditions, the type of deployment, or any other permits or permissions necessary to perform the work. Analysts can use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

6.2.10.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Depending on the physical nature and location of FirstNet facilities or infrastructure and the specific action, some activities would result in potential impacts to environmental justice communities and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result, at the programmatic level, 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 at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, 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* on environmental justice at the programmatic level. 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: At the programmatic level, It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance, impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice communities, it is anticipated that, at the programmatic level, this activity would have no impact on environmental justice issues.

Activities with the Potential to Have Impacts at the Programmatic Level

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, vibrations, 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, vibrations, 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, vibrations, and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore to accept submarine cable could temporarily generate noise, vibrations, 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, vibrations, 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, vibrations, 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, vibrations, 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, vibrations, 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, vibrations, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be *less than significant*, but are problematic from an environmental justice perspective if they occur disproportionately in environmental justice communities. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. Furthermore, site-specific analysis could evaluate site conditions and the impacts of the type of deployment, and could satisfy requirements associated with any other permits or permissions necessary to perform the work. Impacts are expected to be *less than significant* at the programmatic level. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of primarily of routine maintenance and inspection of fixed infrastructure. At the programmatic level, 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, vibrations, and dust) and their duration would be very short. Routine maintenance and inspection would not adversely affect property values, for the same reasons. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment activities that involve construction.

Impacts are expected to be *less than significant* given the short-term nature and limited geographic scope for individual activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

6.2.10.5. Alternatives Impact Assessment

The following section assesses potential impacts to environmental justice associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise, vibrations, and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be *less than significant* because they would be temporary in nature and of a small scale. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

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 vibrations, and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be *less than significant* as operations are expected to be temporary in nature and of a small scale. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

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, at the programmatic level, there would be *no impacts* to environmental justice communities as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.10, Environmental Justice.

6.2.11. Cultural Resources

6.2.11.1. Introduction

This section describes potential impacts to cultural resources in Iowa 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.

6.2.11.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 6.2.11-1. The categories of impacts are defined at the programmatic level as an *adverse effect; mitigated adverse effect; effect, but not adverse;* and *no effect*. These impact categories are comparable to those defined in *36 CFR § 800*, Secretary of

Interior's Standards and Guidelines for Archaeology and Historic Preservation (NPS, 1983), and the United States (U.S.) National Park Service's *National Register Bulletin: How to Apply the National Register Criteria for Evaluation* (NPS, 2002). 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 6.2.11-1: Effect Significance Rating Criteria for Cultural Resources at the Programmatic Level

Type of Effect	Effect Characteristics	Effect Level			
		Adverse Effect	Mitigated Adverse Dffect[a]	Effect, but Not Adverse	No Effect
Physical damage to and/or destruction of historic properties[b]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
	Geographic Extent	Direct effects APE.		Direct effects APE.	Direct effects APE.
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties.		Permanent direct effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
Indirect effects to historic properties (i.e. visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a contributing or non-contributing portion of a single or many historic properties.	No indirect effects to historic properties.
	Geographic Extent	Indirect effects APE.		Indirect effects APE.	Indirect effects APE.
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties.		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties.	No indirect effects to historic properties.
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct or indirect effects to historic properties.
	Geographic Extent	Direct and/or indirect effects APE.		Direct and/or indirect effects APE.	Direct and/or indirect effects APE.
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties.		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties.	No direct or indirect effects to historic properties.

Type of Effect	Effect Characteristics	Effect Level			
		Adverse Effect	**Mitigated Adverse Dffect[a]**	**Effect, but Not Adverse**	**No Effect**
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No segregation or loss of access to historic properties.
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties.		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties.	No segregation or loss of access to historic properties.
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties.		Infrequent, temporary, or short-term changes in access to a single or many historic properties.	No segregation or loss of access to historic properties.

[a] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Measures Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/THPO and other consulting parties, including Indian Tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[b] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian Tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to cultural resources addressed in this section are presented as a range of possible impacts.

6.2.11.3. Description of Environmental Concerns

Physical Damage to and/or Destruction of Historic Properties

One of the primary environmental concerns during deployment activities is damage to or destruction of historic and cultural resources. Deployment involving ground disturbance has the potential to damage or destroy archaeological sites, and the attachment of communications equipment to historic building and structures has the potential to cause damage to features that are historically significant.

Based on the impact significance criteria presented in Table 6.2.11-1, direct deployment impacts could be potentially adverse if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given that archaeological sites and historic properties are present throughout Iowa, some deployment activities may be in these same areas, in which case BMPs (See Chapter 19) would help avoid or minimize the potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of *potentially significant* impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alters historic architectural features. Significant impacts such as these could be avoided or minimized through BMPs (see Chapter 19).

Loss of Access to Historic Properties

The deployment of equipment requiring a secure area has the potential to cause the loss of access to historic properties. The highest potential for this type of adverse impact would be from the deployment of equipment in secure areas that impact the access to sites of cultural importance to

American Indians. At the programmatic level, it is anticipated that FirstNet would identify potential impacts to such areas by conducting research on particular areas and through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

6.2.11.4. Potential Effects of the Preferred Alternative

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

Deployment Effects

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, at the programmatic level, in a range of no effect to potentially adverse effects depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Effect at the Programmatic Level

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* at the programmatic level 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. At the programmatic level, it is anticipated that there would be no effect on 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* on cultural resources at the programmatic level. If required, and if done in existing huts with no ground disturbance, at the programmatic level, installation of new associated equipment would also have no effect on cultural resources because there would be no ground disturbance and no perceptible visual changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: At the programmatic level, it is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not effect 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, at the programmatic level, this activity would have no effect on cultural resources.

Activities with the Potential to Have Effects at the Programmatic Level

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water could impact cultural resources, as shorelines and creek banks in Iowa have the potential to contain prehistoric archaeological sites, as well as sites associated with the state's significant maritime history since European colonization, such as shipwrecks. Impacts to cultural resources could also potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cable, which could result in the disturbance of archaeological and historical sites (archaeological deposits tend to be associated with bodies of water), and the associated network structures could have visual effects on historic properties.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no effect on cultural resources at the programmatic level. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be adverse effects on cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-

term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
  - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in impacts to archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas that have larger numbers of historic buildings.
  - Deployable Technologies: Implementation of deployable technologies could result in potential adverse effects on 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 effects on cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect effects including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment sites. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally, as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Effects

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. At the programmatic level, it is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties, however, due to the small scale of expected activities, these actions could affect but would likely not adversely affect cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 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.

6.2.11.5. Alternatives Effect 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 Effects

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Effects

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, at the programmatic level, there would be effects, but no adverse effects, to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that, at the programmatic level, there would be no effects to cultural resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur, however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no effecton cultural resources at the programmatic level as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.11, Cultural Resources.

6.2.12. Air Quality

6.2.12.1. Introduction

This section describes potential impacts to Iowa'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.

6.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Iowa's air quality were evaluated using the significance criteria presented in Table 6.2.12-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures 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.

Table 6.2.12-1: Air Quality Impact Significance Rating Criteria at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with 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

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 Iowa's air quality addressed in this section are presented as a range of possible impacts.

6.2.12.3. Description of Environmental Concerns

Increased Air Emissions

The Proposed Action has the potential to generate air pollutant emissions. These emissions could be above and beyond what is typically generated in a given area and may alter ambient air quality. Deployment activities may involve the use of vehicles, heavy equipment, and other equipment that could emit exhaust and create fugitive dust in localized areas. During operations, routine maintenance and other use of generators at tower facilities may emit exhaust for specific durations (maintenance) or unpredictable timeframes (if power is lost to a site, for example). Impacts are likely to be *less than significant* at the programmatic level 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 Iowa that are in maintenance or nonattainment for one or more criteria pollutants, particularly, SO2 in Muscatine County and lead in Pottawattamie County (see Section 6.1.12, Air Quality and Figure 6.1.12-1. Muscatine and Pottawattamie Counties are designated as maintenance areas for Lead and SO_2 (Table 6.1.12-4 and Figure 6.1.12-1).

Based on the significance criteria presented in Table 6.2.12-1, 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 Iowa; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present in Iowa (Figure 6.1.12-1), FirstNet would try to minimize potential emissions where possible and would recommend the implementation of BMPs, where feasible and practicable, to avoid or minimize potential impacts.

6.2.12.4. Potential Impacts of the Preferred Alternative

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

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range, at the programmatic level, from *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, 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. At the programmatic level, 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 at the programmatic level.
  - 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, at the programmatic level that this activity would have no impact on those resources.

Activities with the Potential to Impact at the Programmatic Level

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* at the programmatic level 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 or near bodies of water could generate products of combustion from vessels used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.
- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If the delivery of 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* at the programmatic level due to the limited nature of the deployment. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. At the programmatic level, it is anticipated that there would be *less than significant* impacts to air quality associated with routine inspections of the Preferred Alternative due to the limited nature of the activity. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, additional air quality impacts may occur, however, they would be *less than significant* as they would still be limited in nature. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

6.2.12.5. Alternatives Impact Assessment

The following section assesses potential impacts to air quality associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows:

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be *less than significant* based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The concentrations and associated impacts would be dictated by the products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be *less than significant*, given that these activities are of low-intensity and short duration. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact on ambient air quality at the programmatic level. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

6.2.13. Noise and Vibrations

6.2.13.1. Introduction

This section describes potential noise and vibration impacts from construction, deployment, and operation of the Proposed Action and alternatives in Iowa. 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.

6.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise and vibration impacts of the Proposed Action were evaluated using the significance criteria presented in Table 6.2.13-1. As described in Section 6.2, Environmental Consequences, the categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures 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 Iowa addressed in this section are presented as a range of possible impacts.

Table 6.2.13-1: Impact Significance Rating Criteria for Noise and Vibrations at the Programmatic Level

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 and vibration levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific state noise limits. Noise levels plus baseline noise levels would exceeds 10 dBA increase from baseline noise levels (i.e., louder). Project noise levels near noise receptors at National Parks would exceed 65 dBA.	Effect that is *potentially significant,* but with mitigation is *less than significant*.	Noise levels resulting from project activities would exceed natural sounds, but would not exceed typical noise levels from construction equipment or generators.	Natural sounds would prevail. Noise generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.
	Geographic Extent/Context	County or local.		County or local.	County or local.
	Duration or Frequency	Permanent or long-term.		Short term.	Temporary.

6.2.13.3. Description of Environmental Concerns

Increased Noise and Vibration Levels

The Proposed Action has the potential to generate noise and vibration during construction and operation of various equipment used for deployment. These noise and vibration levels could be above what is typically generated in a given area and may alter the ambient acoustical environment. If significant, the noise and vibration could cause impacts on residential areas, or other facilities that are sensitive to noise and vibrations, such as churches, hospitals, or schools. The construction activities for deploying some of the various equipment evaluated under the Proposed Action could cause short-term impacts to nearby populations. However, it is likely that there would be less long-term effects from operational use of the proposed equipment.

Based on the significance criteria presented in Table 6.2.13-1, noise and vibration impacts would likely be *less than significant* given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of noise and vibration sources be deployed/operated long-term in the same area. Noise and vibration levels from deployment activities are not expected to exceed typical noise and vibration levels for short-term/temporary construction equipment or generators.

To the extent practicable, FirstNet would attempt to mitigate or minimize noise and vibration effects during construction or operation. BMPs and mitigation measures would be followed to limit impacts on nearby noise and vibration -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 and vibration impacts due to construction and operations at various receptors.

6.2.13.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise and vibration impacts and while others would not.

In addition, the same type of Proposed Action Infrastructure could result, at the programmatic level, 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 at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no noise or vibration 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 and vibrations 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 or vibration 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. At the programmatic level, it is anticipated that insignificant levels of noise and vibrations would be emitted during installment of this equipment. Noise and vibrations 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 noise or vibration sensitive resources at the programmatic level.
  - 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 or vibration- sensitive resources, it is anticipated that, at the programmatic level, this activity would have no impact on those resources.

Activities with the Potential for Noise and Vibration Impacts at the Programmatic Level

Construction, deployment, and operation activities related to the Preferred Alternative could create noise and vibration 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 or vibration 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 and vibration levels from the use of vehicles and machinery.
- Collocation on Existing Aerial Fiber Optic Plant: Excavation equipment used during potential pole replacement, and other heavy equipment used for structural hardening or reinforcement, could result in temporary increases in noise and vibration 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 and vibration levels if the activity required the use of heavy equipment for grading or other purposes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water could generate noise if vessels are used to lay the cable. In addition, the construction of landings and/or facilities on shore to accept submarine cable could result in short-term and temporarily increased noise and vibration levels to local residents and other noise and vibration- sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise or vibrations 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. There would be *no impacts* long-term from vibrations. 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 and vibrations. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise and vibration 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 and vibration environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise and vibration 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 and vibrations during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise and vibration environment.

In general, noise and vibration 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* at the programmatic level due to the temporary duration of deployment activities. Additionally, pre-existing noise and vibration levels would be achieved after some months (typically less than a year, but could be a few hours for linear activities such as pole construction). Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be *less than significant* and for routine maintenance and inspection of the facilities because of the temporary nature of the activities which would note create new permanent sources of noise and vibration. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. At the programmatic level, it is anticipated that potential noise and vibration 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 and vibration 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.

6.2.13.5. Alternatives Impact Assessment

The following section assesses potential noise and vibration 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 and vibration impacts are as follows:

Deployment Impacts

Implementing deployable technologies could result in noise and vibration from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise and vibration levels. Several vehicles traveling together could also create short-term noise and vibration impacts on residences or other noise or vibration-sensitive receptors as they pass by. With the exception of balloons, the deployment of aerial technology is anticipated to generate noise and vibration during all phases of flight. Aerial technologies would have the highest level of noise and vibration impact if they are required to fly above residential areas, areas with a high concentration of noise or vibration-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 and vibration in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise and vibration impacts could be minimal in these areas. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. At the programmatic level, it is anticipated that potential noise and vibration impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise and vibration 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. Noise and vibration levels would quickly return to baseline levels. This could generate *less than significant* short-term impacts on any residential areas or other noise and vibration -sensitive receptors under the flight path of these vehicles. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact on ambient noise or vibrations. By not deploying the NPSBN, FirstNet would avoid generating noise and vibrations from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

6.2.14. Climate Change

6.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable FirstNet installations and infrastructure in Iowa 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.

6.2.14.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on climate and potential climate change impacts on the Proposed Action's installations and infrastructure were evaluated using the significance criteria presented in Table 6.2.14-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures incorporated, less than significant,* or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to climate and climate change-vulnerable resources addressed in this section are presented as a range of possible impacts.

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or alternatives. The second is related to the implications and possible effects of climate change on the environmental consequences of the Proposed Action or alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or alternatives (CEQ, 2014).

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 6.2.14-1: Impact Significance Rating Criteria for Climate Change at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less Than Significant with Mitigation Measures Incorporated	Less Than Significant	No Impact
Contribution to climate change through GHG emissions	Magnitude or Intensity	See discussion in Section 6.2.14.5 Potential Impacts of the Preferred Alternative	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.	NA
	Duration or Frequency			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

6.2.14.3. Projected Future Climate

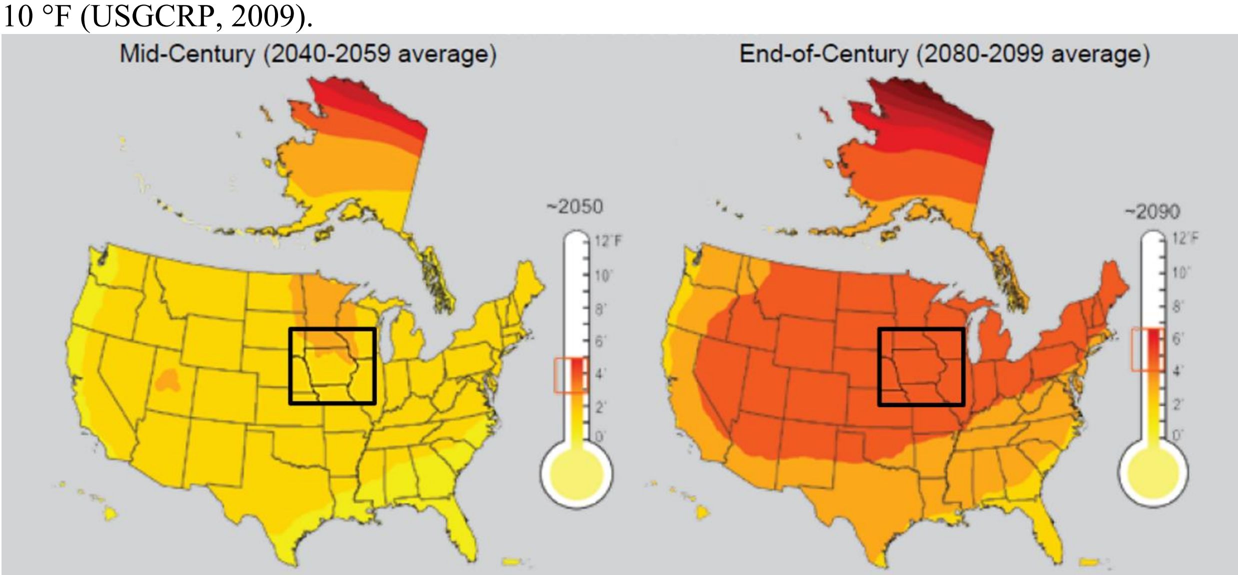
Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high). By mid-century under a high emissions scenario, the total number of hottest days (days above 95ºF) is projected to increase by mid-century (2041 – 2070) as compared to a 1971 – 2000 baseline in the Midwest with the number of hottest days increasing by 5 to 25 days per year in Iowa depending on the region of the state. Additionally, much of the Midwest is projected to observe a longer frost-free season by mid-century as compared to a 1971 – 2000 baseline, where a frost-free season is defined as the period between the last occurrence of 32°F in the spring and the first occurrence of 32°F in the fall. In Iowa, the frost-free season under a high emissions scenario may extend up to 23 days longer than the baseline years in some areas of the state. (USGCRP, 2014a)

Air Temperature

Figure 6.2.14-1 and Figure 6.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for Iowa from a 1969 to 1971 baseline.

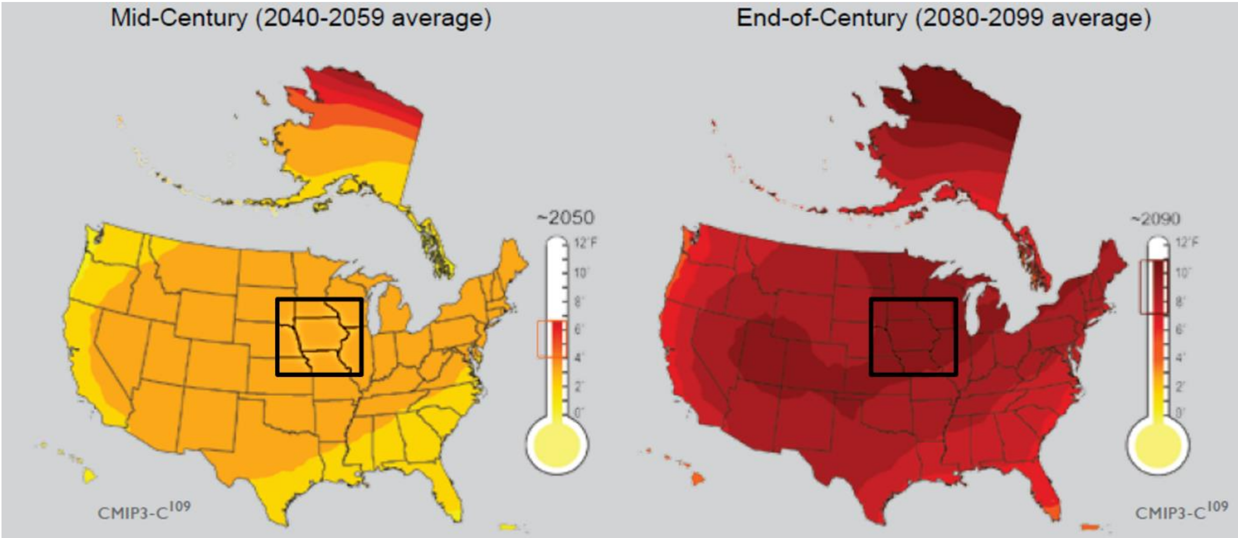
Dfa – Figure 6.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the majority of Iowa under a low emissions scenario would increase by approximately 4°F while a small portion could expect increases of 5°F, and by the end of the century (2080 to 2099) under a low emissions scenario temperatures in the entire state of Iowa would increase by approximately 6°F. (USGCRP, 2009)

Figure 6.2.14-2 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 Dfa region of Iowa, temperatures would increase by approximately 10 °F (USGCRP, 2009).



Source: (USGCRP, 2009)

Figure 6.2.14-1*:* Iowa Low Emission Scenario Projected Temperature Change



Source: (USGCRP, 2009)

Figure 6.2.14-2: Iowa High Emission Scenario Projected Temperature Change

Precipitation

Precipitation in the Midwest is greatest in the east, occurring, on average, once every three days in the southeastern part of the region. The 10 wettest days of the year could contribute as much as 40 percent of total precipitation in a given year. Over the last 100 years, the intensity of precipitation events has increased, with this trend expected to continue in the future (USGCRP, 2014a).

"Snowfall varies across the region, comprising less than 10% of total precipitation in the south, to more than half in the north, with as much as two inches of water available in the snowpack at the beginning of spring melt in the northern reaches of the river basins. When this amount of snowmelt is combined with heavy rainfall, the resulting flooding can be widespread and catastrophic… Historical observations indicate declines in the frequency of high magnitude snowfall years over much of the Midwest, but an increase in lake effect snowfall. These divergent trends and their inverse relationships with air temperatures make overall projections of regional impacts of the associated snowmelt extremely difficult. Large-scale flooding can also occur due to extreme precipitation in the absence of snowmelt… These warm-season events are projected to increase in magnitude" (USGCRP, 2014a).

Figure 6.2.14-3 and Figure 6.2.14-4 show predicted seasonal precipitation change for an approximate 30-year period of 2071 to 2099 compared to a 1970 to 1999 approximate 30-year baseline. Figure 6.2.14-3 shows seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050 (USGCRP, 2014b).

Figure 6.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. (Note:

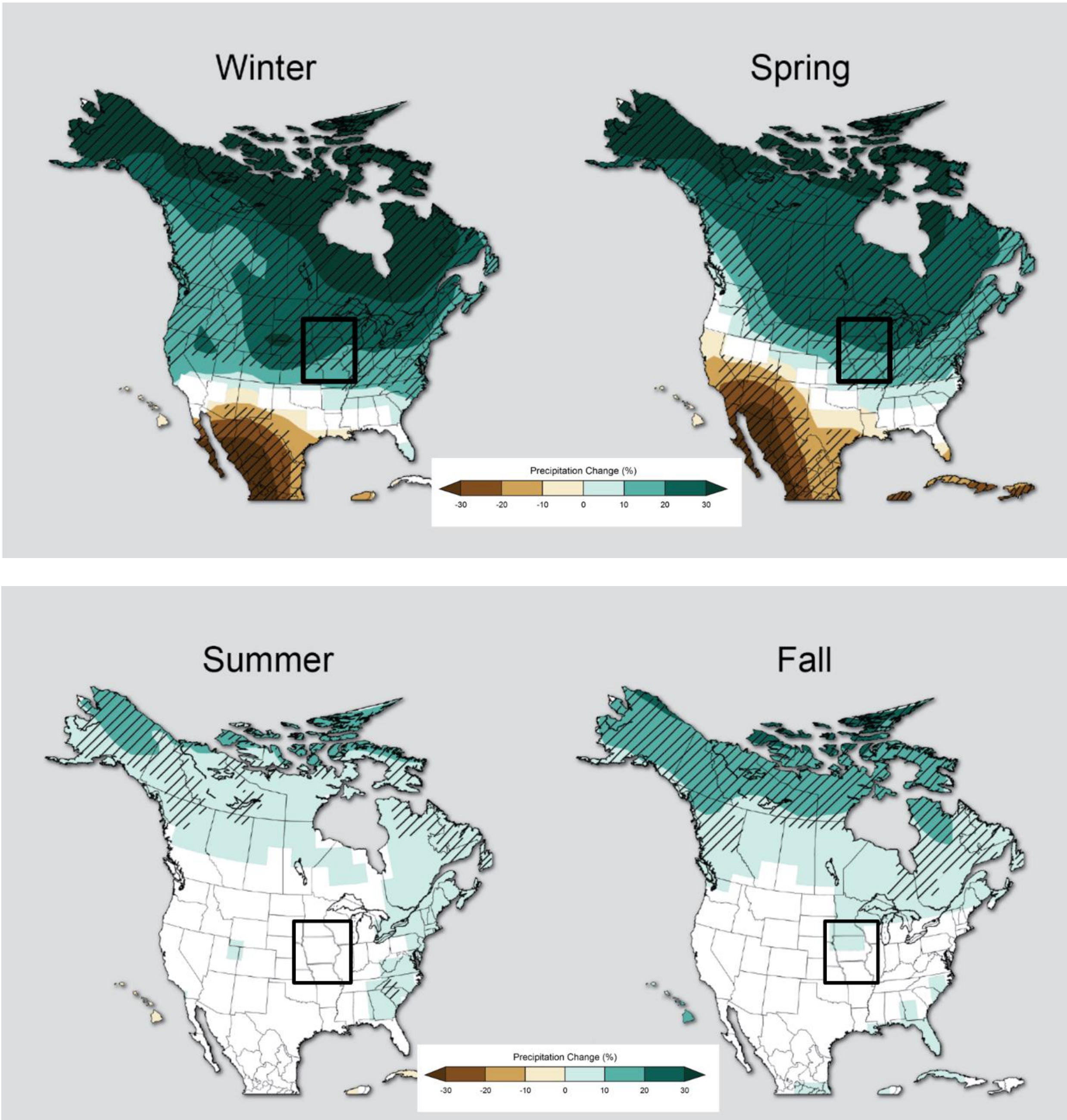
white areas in the figures indicate that the changes are not projected to be larger than could be expected from natural variability.) (USGCRP, 2014b)

Dfa - Figure 6.2.14-3 shows that in a low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent in winter and spring for the entire state. However, there are no expected changes in precipitation in summer other than fluctuations due to natural variability. Fall precipitation is expected to increase 10 percent in the north while other precipitation in other portions of the state are expected to remain constant (USGCRP, 2014b).

Figure 6.2.14-4 shows that if emissions continue to increase, winter and spring precipitation could increase as much as 30 percent over the period 2071 to 2099 in some portions of the Dfa region while other portions will only increase 20 percent. Summer precipitation is expected to decrease 10 percent in this scenario. In fall, precipitation is projected to increase 10 percent in half of the state and remain constant in the other half of the state (USGCRP, 2014b).

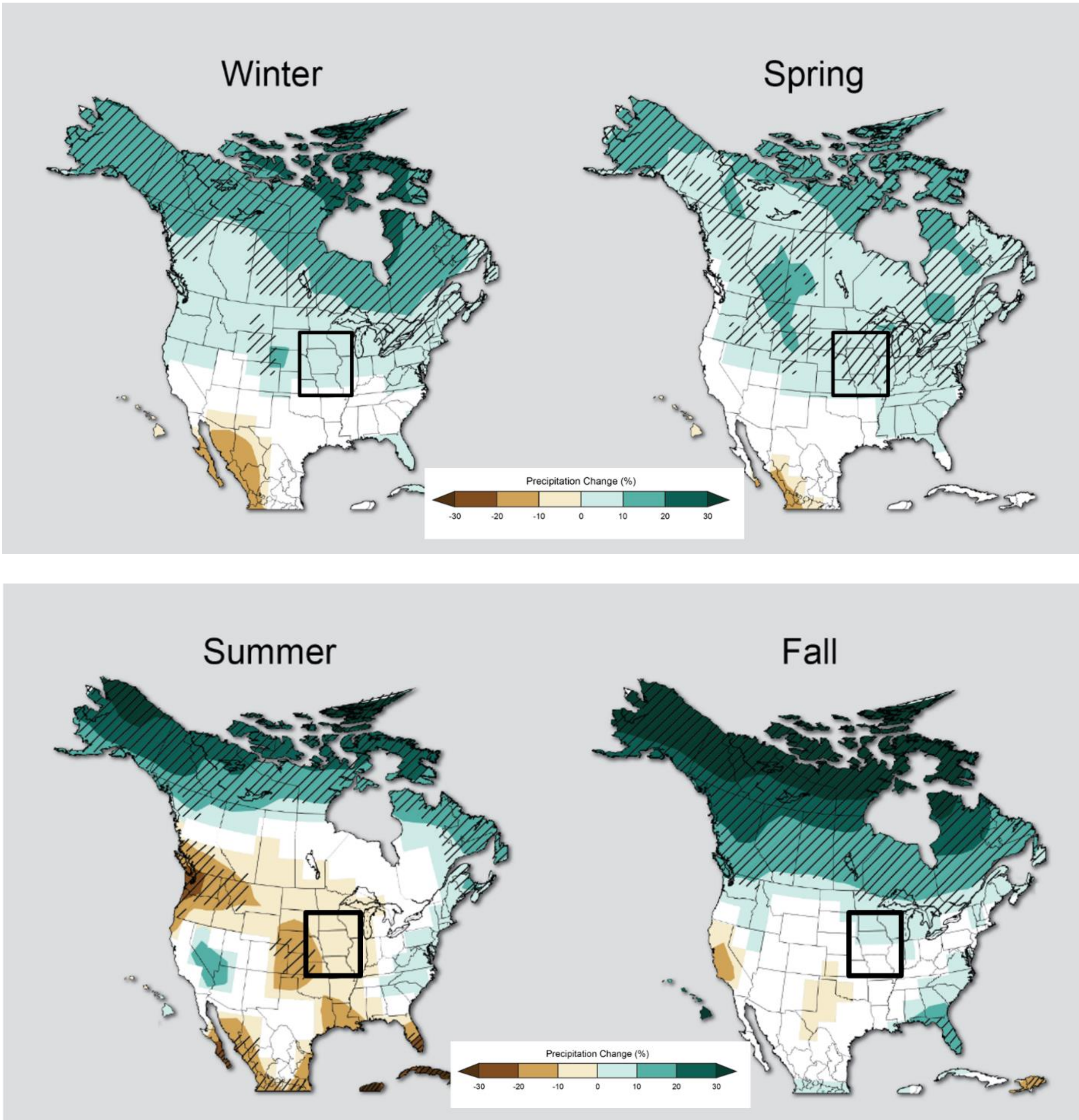
Severe Weather Events

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 establish definitive links between severe weather events and climate change (USGCRP, 2014c).



Source: (USGCRP, 2014b)

Figure 6.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario



Source: (USGCRP, 2014b)

Figure 6.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

6.2.14.4. Description of Environmental Concerns

Greenhouse Gas Emissions

Increases in GHG emissions have altered the global climate, leading to generalized temperature increases, weather disruption, increased droughts and heatwaves, and may have potentially catastrophic long-term consequences for the environment. Although GHGs are not yet regulated by the federal government, many states have set various objectives related to reducing GHG emissions, particularly CO_2 emissions from fossil fuels.

Based on the impact significance criteria presented in Table 6.2.14-1, climate change impacts as a result of GHG emissions could be significant and require a quantitative analysis if FirstNet's deployment of technology was responsible for increased emissions. 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.

Climate Change

Climate change may impact project-related effects by magnifying or otherwise altering impacts in other resources areas. For example climate change may impact air quality, water resource availability, and recreation. These effects would vary from state to state depending on the resources in question and their relationship to climate change. In Iowa, climate change could have beneficial and harmful effects on agriculture, flora, and fauna. Changes in average temperature have already increased the length of the growing season, while increases in extreme precipitation are increasing runoff and damage to Iowa's topsoil and receiving water bodies (Iowa Climate Change Impacts Committee, 2011). Continued warming will shift agricultural and livestock production, as well as natural habitats, northwards or to cooler areas, or require adaptation by growers as well as native species (IDNR, 2016d). Climate change is expected to increase the duration and intensity of heatwaves in the Midwest (USGCRP, 2014a). Climate change is also expected to raise the temperature of lakes, ponds, rivers, and other water bodies, making them more vulnerable to harmful algal blooms and other types of biological contamination, particularly when combined with extreme rainfall events (USEPA, 2015p).

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. Based on the impact significance criteria presented in Table 6.2.14-1, climate change effects on FirstNet installations and infrastructure would be significant at the programmatic level if they negatively affected the operation of these facilities. For areas of Iowa at risk for flooding, climate change is projected to increase the frequency and severity of torrential downpours which in turn may increase the potential for flash floods (USGCRP, 2014d). This could negatively impact FirstNet infrastructure as well as magnify the extent and gravity of flood-related disasters and their impacts on Iowa's infrastructure and emergency services (Iowa Climate Change Impacts Committee, 2011). Extended periods of extreme heat may increase general demand on the electric grid, impede the operation of the grid in the Midwest region (Energy.Gov - Office of Energy Policy and Systems Analysis, 2015) and overwhelm the capacity onsite equipment needed to keep microwave and other transmitters cool.

6.2.14.5. Potential Impacts of the Preferred Alternative

Greenhouse Gas Emissions

Given this assessment is programmatic and does not include any site-specific locations or deployment technology, it is impossible to determine the actual GHG emissions associated with any of the action alternatives. This information could only be captured once the site-specific information is determined. However, an assessment of potential impacts is provided in this section based on the potential emissions associated with the various activities that could occur as a result of the implementation of the Preferred Alternative in Iowa, 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, at the programmatic level, 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 at the Programmatic Level

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action, at the programmatic level, the following are likely to have *no impacts* to climate change under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions. This would create no perceptible change in GHG emissions.
- Satellites and Other Technologies
  - Satellite Enabled Devices and Equipment: The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create

any perceptible changes in GHG emissions because they would not create any new emissions sources.
    - Deployment of Satellites: 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.

Activities with the Potential to Have Impacts at the Programmatic Level

The deployment and use of energy-consuming equipment as a result of the implementation of the Preferred Alternative would result in GHG emissions whose significance would vary depending on their power requirements, duration, and intensity of use, and number. The types of infrastructure deployment scenarios that could be part of the Preferred Alternative and result in potential impacts to GHG emissions and climate change include the following:

- Wireless Projects
    - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
    - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.
    - Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities.
    - New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small marine sources would contribute to GHGs.
    - Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.
- Wireless Projects
    - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.

  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with construction as construction would not take place. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
- Deployable Technologies
  - COWs, COLTs, or SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However, this would be highly dependent on their size, number, and the frequency and duration of their use. Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of piloted or unmanned aircraft were used for a sustained period of time (i.e. months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be *less than significant* at the programmatic level due to the limited and localized nature of deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

At the programmatic level, 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.

6.2.14.6. Alternatives Impact Assessment

The following section assesses potential impacts to climate associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be *less than significant* at the programmatic level 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, and 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* at the programmatic level due to the limited duration and extent of deployment activities. 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 activities are expected to be *less than significant* at the programmatic level due to the limited duration of deployment activities.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be *less than significant*, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. Climate change effects have the most noticeable impacts over a long period of time. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of the deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above. 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 the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.14, Climate Change.

6.2.15. Human Health and Safety

6.2.15.1. Introduction

This section describes potential impacts to human health and safety in Iowa 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.

6.2.15.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on human health and safety were evaluated using the significance criteria presented in Table 6.2.15-1. The categories of impacts are defined, at the programmatic level, as *potentially significant, less than significant with mitigation measures incorporated, less than significant,* or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to human health and safety addressed in this section are presented as a range of possible impacts.

Table 6.2.15-1: Impact Significance Rating Criteria for Human Health and Safety at the Programmatic Level

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA.	Effect is *potentially significant,* but with mitigation is *less than significant*.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation 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
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural and Manmade Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is *potentially significant,* but with mitigation is *less than significant*.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

NA = Not Applicable

6.2.15.3. *Description of Environmental Concerns*

Worksite Physical Hazards, Hazardous Materials, and Hazardous Waste

The human health and safety concern having the greatest likelihood to occur during FirstNet deployment activities is occupational injury to telecommunication workers. The nature of telecommunication work requires workers to execute job responsibilities that are inherently dangerous. Telecommunication work activities present physical and chemical hazards to workers. The physical hazards have the potential to cause acute injury, long-term disabilities, or in the most extreme incidents, death. Other occupational activities such as handling hazardous materials and hazardous waste often do not result in acute injuries, but may compound over multiple exposures, resulting in increased morbidity. Based on the impact significance criteria presented in Table 6.2.15-1, occupational injury impacts could be *potentially significant* if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites.

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).

- Engineering controls;
- Work practice controls;
- Administrative controls; and then
- Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes,[139] chain locks, bollards, storage containers (for storing equipment and chemicals), or signage and caution tape. Other forms of engineering controls could include machinery designed to manipulate the quality of the work environment, such as ventilation blowers. Whenever practical, engineering controls may result in the complete removal of the hazard from the work site, an example of which would be the transport and offsite disposal of hazardous waste or asbestos containing materials.

Work practice controls could be implemented as abiding by specific OSHA industry standards, such as the Confined Space Entry standard (29 CFR 1910.146) or thru the development of

[139] Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents. (OSHA, 2016b)

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.

The Iowa Division of Labor Services (IDLS) is authorized by OSHA to administer the state program which oversees employee safety in all state and local government and private sector workplaces. The involvement of state and local employees will be limited to emergency responders (e.g., police, fire, emergency medical transporters, etc.) and local government permitting authorities.

Hazardous Materials, Hazardous Waste, and Mine Lands

The presence of environmental contamination at FirstNet deployment sites has the potential to negatively impact health and safety of workers and the general public. Past or present contaminated media, such as soil and groundwater, may be present and become disturbed as a result of site activities. 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 6.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination 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 IDNR, or through an equivalent commercial resource.

By screening sites for environmental contamination, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, CERCLA, and applicable Iowa 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 IDNR may require FirstNet to perform environmental clean-up actions at the site to lower the existing levels of contamination. HHRAs help determine which level of PPE (i.e., Level D, Level C, Level B, or Level A) is necessary for a work activity. HHRAs take into account all exposure pathways: absorption, ingestion, inhalation, and injection. Therefore, specific protective measures (e.g., controls and PPE) that disrupt the exposure pathways could be identified, prioritized, and implemented.

Natural and Manmade Disasters

FirstNet is intended to improve connectivity among public safety entities during disasters, thereby improving their ability to respond more safely and effectively during such events. The addition of towers, structures, facilities, equipment, and other deployment activities is expected to allow for expedited responses during natural and manmade disasters. The impacts of natural and manmade disasters are likely to present health and safety hazards, as well as exacerbate pre-existing hazards, such as degrading occupational work conditions and disturbing existing environmental contamination. The hazards presented by natural and manmade disasters may include, fire, weather incidents (e.g., floods, tornadoes, hurricanes, etc.), earthquakes, vandalism, large- or small-scale chemical releases, utility disruption, community evacuations, or any other event that abruptly and drastically denudes the availability or quality of transportation infrastructure, utility infrastructure, medical infrastructure, and sanitation infrastructure. Additionally, such natural and manmade disasters could directly impact public safety communication infrastructure assets through damage or destruction.

Based on the impact significance criteria presented in Table 6.2.15-1, human health impacts could be significant if FirstNet deployment sites are located in areas that are directly impacted by natural and manmade disasters that could lead to exposure to hazardous wastes, hazardous materials, and occupational hazards. FirstNet's emphasis on public safety-grade communications infrastructure may result in a *less than significant* beneficial impact, as new infrastructure could be deployed with additional structural hardening, and existing infrastructure may also be hardened as appropriate and feasible, in an effort to reduce the possibility of infrastructure damage or destruction to some degree.

Potential mitigation measures for natural disasters is to be aware of current weather forecasts, forest fire activities, seismic activities, and other news worthy events that may indicate upcoming disaster conditions. Awareness provides time and opportunity to plan evacuation routes, to relocate critical equipment and parts, and to schedule appropriate work activities preceding and after the natural disaster. These mitigation steps reduce the presence of workers and dangerous work activities to reduce the potential for injury or death. Manmade disasters could be more difficult to anticipate due to the unexpected or accidental nature of the disaster. Though some manmade disasters are due to malicious intentions, many manmade disasters result from human error or equipment failure. The incidence of manmade disasters affecting FirstNet deployment sites would be difficult to predict and diminish because the source of such disasters is most likely to originate from sources independent of FirstNet activities. Therefore, FirstNet partner(s) would develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster.

6.2.15.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts at the Programmatic Level

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, at the programmatic level, 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, at the programmatic level, 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* on human health and safety at the programmatic level 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, at the programmatic level, that this activity would have no impact on those resources.

Activities with the Potential to Have Impacts at the Programmatic Level

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, vibrations, and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity.

Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in or near 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 RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise and vibrations 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,noise, and vibrations. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to

Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, 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 the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure and release 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 and vibration exposure, and risk of infectious disease transmission would be *less than significant* at the programmatic level due to the small scale of likely FirstNet activities that would be temporary and of short duration. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be *less than significant* impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise and vibration exposure, and risk of infectious disease transmission would be *less than significant* at the programmatic level 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.

6.2.15.5. Alternatives Impact Assessment

The following section assesses potential impacts to human health and safety associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source is an electrical generator, then there would also likely be a need to manage hazardous materials (fuel) onsite. These activities could result in *less than significant* impacts to human health and safety. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise and vibration exposure, and risk of infectious disease transmission would be *less than significant* at the programmatic level 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, at the programmatic level, 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* at the programmatic level to human health and safety as a result of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 6.1.15, Human Health and Safety.

ACRONYMS

Acronym	Definition
AARC	Average Annual Rate of Change
ACHP	Advisory Council On Historic Preservation
ACS	American Community Survey
AGL	Above Ground Level
AIM	Aeronautical Information Manual
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
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
CAA	Clean Air Act
CCC	Civilian Conservation Corps
CCD	Common Core of Data
CEQ	Council On Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFOI	Census of Fatal Occupational Injuries
CFR	Code of Federal Regulations
CGP	Construction General Permit
CH_4	Methane
CID	Eastern Iowa Airport
CIMC	Cleanups In My Community
CIRPSCS	Central Iowa Communications System
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 System
DAS	Department of Administrative Services
DOE	Department of Energy
DPS	Department of Public Safety
DSM	Des Moines International Airport
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

Acronym	Definition
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highways Administration
FLM	Federal Land Manager
FLMPA	Federal Land Policy and Management Act of 1976
FR	Federal Register
FRA	Federal Railroad Administration
FSDO	Flight Standards District Offices
FSS	Flight Service Station
FTA	Federal Transit Authority
GAO	Government Accountability Office
GHG	Greenhouse Gas
GNIS	Geographic Names Information System
HAP	Hazardous Air Pollutants
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IA	Iowa
IBA	International Birding Area
ICN	Iowa Communications Network
IDHHS	Iowa Department of Health and Human Services
IDLS	Iowa Division of Labor Services
IDNR	Iowa Department of Natural Resources
IDOT	Iowa Department of Transportation
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
IPHT	Iowa Public Health Tracking
ISICSB	Iowa Statewide Interoperable Communications Systems Board
ISP	Iowa State Patrol
IUB	Iowa Utilities Board
LBS	Locations-Based Services
LCCS	Land Cover Classification System
LID	Low Impact Development
LMR	Land Mobile Radio
LPG	Liquefied Petroleum Gas
LRR	Land Resource Region
LTE	Long Term Evolution
MBTA	Migratory Bird Treaty Act
MDI	Methylene Diphenyl Diisocyanate
MHI	Median Household Income
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tons
MOA	Memorandum of Agreement

Acronym	Definition
MSDS	Material Safety Data Sheets
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MT	Million Tons
MYA	Million Years Ago
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NASAO	National Association of State Aviation Officials
NEPA	National Environmental Policy Act
NESCA	Nongame and Endangered Species Conservation Act
NESHAP	National Emission Standards For Hazardous Air Pollutants
NFIP	National Flood Insurance Program
NHA	National Heritage Area
NHL	National Historic Landmarks
NHPA	National Historic Preservation Act
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
NRC	National Response Center
NRCS	National Resources Conservation Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NSPS	New Source Performance Standards
NTFI	National Task Force On Interoperability
NTFI	National Task Force On Interoperability
NTIA	National Telecommunications Information Agency
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
OHV	Off-Highway Vehicle
OSHA	Occupational Safety and Health Administration
OTR	Ozone Transport Region
PAB	Palustrine Aquatic Bed
PADUS	Protected Areas Database of the United States

Acronym	Definition
PAH	Polycyclic Aromatic Hydrocarbons
PEM	Palustrine Emergent Wetlands
PFO	Palustrine Forested Wetlands
PGA	Peak Ground Acceleration
PM	Particulate Matter
POP	Points of Presence
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PSS	Palustrine Scrub-Shrub Wetlands
PUB	Palustrine Unconsolidated Bottom
R&D	Research and Development
RACOM	Radio Communications
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
RFP	Request For Proposal
ROW	Right-of-Way
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SCEC	State Climate Extremes Committee
SCIP	Statewide Communication Interoperability Plan
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SF_6	Sulfur Hexafluoride
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SO_3	Sulfur Trioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SOW	System on Wheels
SO_X	Oxides of Sulfur
SPL	Sound Pressure Level
STARCOMM	Siouxland Tri-State Area Radio Communications
SUA	Special Use Airspace
SWAP	State Wildlife Action Plan
SWPPP	Stormwater Pollution Prevention Plan
TCA	the Community Agency
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
TNC	Transient Non-Community Systems
TPY	Tons Per Year
TRI	Toxics Release Inventory
TS	Terminology Services

Acronym	Definition
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UHF	Ultra-High Frequency
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
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compounds
WCS	Wetlands Classification Standard
WMA	Wildlife Management Areas
WMD	Wetland Management District
WONDER	Wide-Ranging Online Data For Epidemiologic Research
WWI	World War I
WWII	World War II

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